2009

# COMPARATIVE ANALYSIS OF CURRENT TRAINING AND PROPOSED TRAINING INITIATIVES FOR SMOG CHECK TECHNICIANS

**Prepared by**

**COMIRA**
**Psychometric Services Division**
**110 Blue Ravine Road, Suite 160**
**Folsom, California 95630**

**FINAL REPORT**
**2/6/2009**

# EXECUTIVE SUMMARY

The Bureau of Automotive Repair (BAR) is at a crossroads in its approach to Smog Check technician training. BAR recognized that its curriculum and training materials are outdated. BAR also recognized concerns with regard to the effectiveness and durability of the repairs performed by its technicians. This report provides an independent assessment of BAR's training strategies, processes and procedures and recommendations for sustainable options that would better meet its training needs. Data were gathered from interviews, survey questionnaires and workshops. BAR provided archival data that included enrollment statistics, candidate pass/fail results, and recent proposals to restructure the training program.

The principal findings and recommendations are detailed below.

1. *Current licensing strategy*. Training and licensing requirements for technicians who only conduct inspections are excessive and should not include diagnosis and repair. Highly-trained/experienced technicians should have different pathways to licensure than entry-level technicians. The Basic Area Technician (EB) license should be phased out because very few technicians took the examination and very few hold the EB license.

*Recommendations*:

- Establish sequentially progressive training to accommodate different experience levels (inexperienced vs. experienced).
- Phase out the EB license. Require existing EB technicians to successfully complete additional coursework prior to accepting positions in Enhanced Areas.
- Create a two-tiered system for licensing technicians who conduct inspections vs. technicians who perform diagnosis and repair.
- Restructure course content into a modular format to allow flexibility in content and course offerings.
- Require current ASE A6, A8, L1 and/or driveability certifications for biennial renewal of technicians who perform diagnosis and repair.

2. *Current curriculum*. Current curriculum and course hours need to be overhauled and course materials should be updated and better integrated.

*Recommendations*:

- Incorporate more hands-on exercises that involve commonly encountered inspection and diagnostic situations.
- Develop a pass/fail hands-on "end-of-course" exercise to be administered as part of the final examination.
- Restructure courses into a modular format to ease the process of adding new program requirements.

- Establish training modules for licensed technicians who conduct inspections vs. technicians who perform diagnosis and repair, including a hands-on examination of skills.
- Establish training modules to facilitate different types of inspection including OBD II only, diesel, tailpipe.

3. *School/instructor performance*. Initial pass rates on the BAR licensing examination for training institutions vary significantly from institution to institution. Students who received training from California community colleges had the highest pass rate (75%) followed by private institutions (58%), and, Regional Opportunity Programs (ROP)/high schools/adult education programs (55%).

*Recommendations*:
- Refine selection criteria and procedures for certifying instructors.
- Develop criteria and procedures to audit training institutions and identify underachieving instructors.
- Develop procedures to verify the required amount of experience prior to admitting the students into the Smog Check technician program.

4. *Role of BAR, instructors and SMEs in course content, curriculum and textbook approval*. The existing process is untenable because BAR performs a comprehensive editorial review rather than a "go/no-go" process. For example, a book is reviewed for technical content and editorial integrity such that BAR staff are required to provide edits for errors in grammar, spelling and punctuation as well as assist the authors in identifying weaknesses and improving the quality and coverage of the book, e.g., relocating sentences, paragraphs, or sections within a document.

   The majority of instructors indicated that BAR should work with outside expertise, i.e., subject matter experts (SMEs) paid by the state or committees of educators, to identify course content, course curriculum, and textbook/resource material approval.

*Recommendations*:
- Under BAR's guidance and direction, contract with a single vendor to guide committees of SMEs to develop curriculum, curriculum standards, selection procedures for instructors and outcome measures for students and training institutions.
- Under BAR's guidance and direction, contract with a single vendor to provide course curriculum, textbooks and course materials for new vehicle technologies. The publisher should have technical expertise in emissions testing and automotive repair.
- Contract with a single vendor to design a hands-on "end-of-course examination" that meets BAR's specifications.
- Enhance examination security procedures for vendors and SMEs.

In summary, BAR should effect significant changes in its current licensing strategy and training program. BAR's role in the process should be an authoritative one that

approves/disapproves processes, procedures, and materials developed by knowledgeable vendors.

# TABLE OF CONTENTS

# LIST OF FIGURES



# LIST OF TABLES



# LIST OF APPENDICES

# SECTION 1: INTRODUCTION

BACKGROUND

The Bureau of Automotive Repair (BAR) is at a crossroads in its approach to Smog Check technician training. Important curriculum and training materials are outdated and need to be revised. There is a great deal of concern generated in government, industry, and consumer forums with respect to repair effectiveness and durability, and, consequently, technician training. BAR's Ad Hoc Educational Advisory Committee (AHEAC) and other educators have raised concerns that today's students lack an understanding of the use of hand tools, electrical theory, and/or engine operation basics. Furthermore, BAR recognizes that the current processes for developing training materials and selecting textbooks is labor intensive and may be vulnerable to conflict of interest.

BAR is responsible for the administration of California's vehicle inspection and maintenance program, known as "Smog Check." The program licenses the technicians who perform the vehicle inspections and/or vehicle repairs as well as the 8,000 stations where the inspections are performed. The program also certifies the instructors who teach BAR certified training courses, BAR update training courses, and Citation courses for technicians who have received a citation from BAR. The goal of the Smog Check program is to ensure that in-use vehicles stay clean as they age.

To successfully repair Smog Check failures, technicians must have the ability to analyze the results and determine the correct approach for diagnosis of complex, integrated vehicle emissions control systems. As technology advances with each new vehicle model year, vehicle systems become more complex and place more demands on training of these technicians.

BAR's Standards and Training Unit (part of its Technical Services Branch) is responsible for establishing training requirements for initial Smog Check licensees as well as update training for technicians who renew their licenses. The Standards and Training Unit also establishes the minimum licensing requirements and develops the licensing examinations.

In addition to course requirements, BAR develops textbook specifications, designs, evaluates and approves curricula and course materials, and, certifies schools and instructors for qualifying Smog Check program-related training courses taught in California. BAR inspects the schools periodically to determine if they have the required tools and equipment compliance.

## TRAINING IN OTHER JURISDICTIONS

The training requirements of 10 other jurisdictions are presented in Table 1.

Table 1 – Training requirements of other jurisdictions

| | |
|---|---|
| Delaware | • "Test-out" = L1 certification, minimum score of 75% on examination, 1 training module for program specific information, or, 60 or more hours of training, minimum score of 75% on examination, one training module for program specific information |
| Illinois | • Three contracted instructors leading seven free diagnostic and repair seminars weekday evenings (6 to 10 pm) |
| Maryland | • Two contracted university instructors leading a scan-tool/oscilloscope diagnostic seminar in morning, afternoon and evening courses<br>• Licensure requires A6, A8, L1 certificates and five years experience, or, four years experience and two years related training. |
| Nevada | • Certificate from gas analyzer manufacturer, training course, written examination, hands-on examination<br>• For repairs, L1 certification |
| New Jersey | • A6, A8, L1 certification and training |
| New Mexico | • Pretest to establish general automotive repair competency, three-day training (two-day classroom, one-day hands-on emission testing on consumer volunteer vehicles at no cost to the consumer)<br>• Annual renewal requires four-hour update training |
| Ohio | • EDGE or Ohio 1 training (40 hrs @ $695), A6 and A8 certification<br>• Voluntary training available – Mode 6 ($95), NOx ($35), and OBD II ($35). |
| Pennsylvania | • Aspire training for initial and renewal applicants plus examination |
| Virginia | • Pass a training course or L-1 certification |
| Washington | • A1, A6, A8 certification, examination, training |

## ISSUES AND CONCERNS

### APPROPRIATENESS OF CURRENT LICENSING STRATEGY

Smog Check technicians perform a variety of activities with corresponding skill sets. Many of the activities require low to moderate technical skills. Since most vehicles pass, the majority of Smog Check activities relate to vehicle testing. The current requirements for Smog Check technicians (initial training, update training, licensing examination, etc.) are, for all practical purposes, a "one size fits all" solution. The current strategy conflicts with the actual knowledge skills and abilities needed to perform various Smog Check activities in different practice settings.

BAR's current training strategy requires all technicians to complete emissions-related courses and pass a licensing examination that includes questions on diagnosing and repairing vehicles. However, some stations and technicians conduct Smog Check testing only and do not perform diagnosis or repair vehicles. Moreover, most California automotive repair dealers (ARDs), who perform similar types of diagnostics and repairs, do not require formal Smog Check training or the Smog Check technician license.

Current data indicate that California has approximately 35,000 registered ARDs, with the estimated number of unregulated technicians exceeding 100,000. About 7,600 of the ARDs are Smog Check stations and about 1,800 of the 7,600 are test-only stations, which are prohibited by law from performing repairs. Other studies suggest that large portions of the failed vehicles are repaired at unlicensed ARDs. It appears that a large percentage of the emissions-related repairs and maintenance that occur between inspections are performed at non-licensed ARDs.

## HIGH COST OF SMOG CHECK INSPECTIONS IN CALIFORNIA

California has the highest Smog Check inspection costs in the nation. The average cost of a Smog Check inspection in California is approximately $49 plus $8.25 for the Smog Check certificate. The costs of Smog Check testing are high because technicians are required to possess the skills to diagnose and repair vehicles. Yet there are many settings in which technicians require a lower level of skill to conduct inspections. Approximately 60% of all inspections are conducted at stations that do not perform repairs. There are repair entries for only about 1/4 of vehicles that fail Smog Check. This suggests that many motorists are choosing to have repairs performed by technicians/facilities that are not licensed by BAR.

As seen in Table 1, the costs in California are significantly higher than the national average of $28.20. It should be noted that these states have programs that are smaller and less complex.

Table 2 – Number and cost of annual tests in I/M programs[1]

| ***State*** | ***Annual number of tests conducted*** | ***Fee*** |
|---|---|---|
| Alaska, Anchorage | 50,000 | $45 |
| Alaska, Fairbanks | 25,000 | $33 |
| Arizona, Phoenix | 735,000 | $28 |
| Arizona, Tucson | 344,000 | $12 |
| California | 9,200,000 | $49 |
| Colorado | 1,192,500 | $25 |
| Connecticut | 1,050,000 | $20 |
| Delaware | 180,000 | $20 |
| District of Columbia | 120,000 | $20 |

[1] Data obtained from "Transitioning I/M: Options for inspection and maintenance in the OBD dominated fleet" written by the U.S. Environmental Protection Agency (2008).

| *State* | *Annual number of tests conducted* | *Fee* |
|---|---|---|
| Georgia | 2,200,000 | $25 |
| Idaho | 225,000 | $15 |
| Illinois | 2,900,000 | $20 |
| Indiana | 250,000 | $20 |
| Louisiana | 400,000 | $10 |
| Maine | 200,000 | $13 |
| Maryland | 1,600,000 | $14 |
| Massachusetts | 2,100,000 | $29 |
| Missouri | 600,000 | $24 |
| Nevada | 1,200,000 | $36 |
| New Hampshire | 1,200,000 | $20 |
| New Jersey | 3,000,000 | $36 |
| New Mexico | 220,000 | $20 |
| New York | 5,000,000 | $27 |
| New York Upstate | 5,000,000 | $11 |
| North Carolina | 2,800,000 | $30 |
| Ohio | 1,000,000 | $20 |
| Oregon | 562,500 | $21 |
| Pennsylvania | 5,400,000 | $35 |
| Rhode Island | 330,000 | $47 |
| Tennessee, Memphis | 450,000 | $25 |
| Tennessee, Middle | 1,170,000 | $10 |
| Texas, Dallas-Ft Worth | 2,500,000 | $27 |
| Texas, Houston | 2,500,000 | $27 |
| Texas, El Paso | 350,000 | $14 |
| Texas, Travis, Williamson | 750,000 | $14 |
| Utah, Davis | 160,000 | $25 |
| Utah, Weber | 100,000 | $25 |
| Utah, Utah Co. | 216,000 | $30 |
| Utah, Salt Lake | 536,000 | $25 |
| Vermont | 550,000 | $22 |
| Virginia | 700,000 | $28 |
| Washington | 1,100,000 | $15 |
| Wisconsin | 750,000 | $20 |
| **Total tests conducted** | **60,916,000** | **$28.20** |

## TRANSITION TOWARDS OBD II BASED INSPECTIONS

A recent report issued by the US Environmental Protection Agency (USEPA) indicates that IM programs are transitioning towards OBD II based inspections. The report cites that of emission testing performed during CY 2007, 25.3% of the vehicles tested at a test and repair facility failed as compared with 59% of the vehicles tested at a test only facility. These inspections are simpler, require less complex test equipment, etc., which will likely require more inspection technicians, who will not need to be trained in

complex diagnostic and repair procedures. Currently, about 2/3 of Smog Check tests are performed on OBD II equipped vehicles in California.

### LIMITATIONS OF LICENSING EXAMINATION

The primary focus of the Smog Check Licensing examination is on low skill functions because these functions represent the majority of tasks and the majority of the questions on the examination. This results in the possibility that a technician may fail all diagnostic and repair related questions but still pass the examination.

Previous program evaluations of Smog Check program performance concluded that Smog Check inspections are failing to identify many high-emitting vehicles. Previous studies concluded that between 37% to 48% of the vehicles that should fail Smog Check have been certified even though they should have failed. Data from these reports indicate that many vehicles are not being effectively tested and repaired.

It is important to note that many tasks, requiring a low level of skill, are automated functions controlled by analyzer or BAR's data management system, while other tasks may be performed by individuals other than the technician. For example, in many businesses, the technician may not be the individual who communicates with the motorist but is required to have the information. The person who communicates with the motorist may be a service writer, who is not required to have any training, certification, or license.

### TRAINING INSTITUTIONS DO NOT MEET MINIMUM STANDARDS

BAR's recent evaluation of school enrollment and pass/fail data implies that ineffective instructors/schools accept students into their programs who should not be admitted into the Smog Check training program, and pass students who do not meet minimum standards. It might be beneficial for measuring school performance if there were an independent assessment of student qualifications, e.g., knowledge, skills, and experience and an assessment, including hands-on demonstrations, following the completion of the BAR courses to ensure students are actually meeting minimum standards.

Currently, course examinations have been administered by the schools for many years without safeguards for examination security, e.g., backup examinations, schedule for periodic replacement. BAR does not have resources to develop and maintain credible examinations for schools. Schools/instructors may have a conflict of interest in administering examinations, given that they may feel obligated to issue a certificate to students who paid for the course. As a result, some schools have 100% of their students pass the course, while the overwhelming majority fail the BAR examination. BAR needs to ensure that schools are administering "end-of-course" examinations under secure conditions.

## PRESSURE TO PRODUCE JOURNEY LEVEL TECHNICIANS

The pressure applied to BAR certified instructors to produce journey level Smog Check technicians originates from statutes that mandate only licensed Smog Check technicians conduct inspections and perform repairs. The statutes, however, do not provide for an apprenticeship or mandatory mentorship. If such a program were in place, technicians could obtain the necessary hands-on job skills to perform the job.

## DIVERSITY OF VEHICLES, MODELS, CHANGES IN CONFIGURATION

Today's vehicles originate from a wide array of countries and there are many models produced by each manufacturer. There are configuration changes within model years of vehicles that require substantial training and on-the-job experience to establish competence to service a single generation of vehicles produced by a single manufacturer. Therefore, the challenge for today's technician is to understand configuration changes for models produced by multiple manufacturers.

Training required to provide competent inspection, diagnosis and repair services to such a diversity of vehicles may not be a reasonable expectation. The automotive repair training industry can only reasonably produce entry-level technicians, as opposed to journey level technicians, because California law does not mandate an apprenticeship or work experience under the tutelage of a mentor for newly licensed Smog Check technicians. Training institutions and instructors have the onus to produce journey level Smog Check technicians through training alone.

## LACK OF UNIFORM STANDARDS FOR CERTIFIED INSTRUCTORS

Current standards used by BAR and private training institutions are insufficient for program needs. California code does not require automotive instructors to possess a college degree nor vocational education certificate. Community colleges state that adjunct faculty "should" have a minimum of an associate (AS) degree and six years of industry experience. Prior to the sunset of the Bureau for Private Postsecondary and Vocational Education (BPPVE), the minimum requirements for instructors employed by private institutions was "the possession of a credential generally recognized in the field of instruction." This standard is ambiguous and subject to interpretation, and could allow for certifications that are not sufficient relative to the level of competence necessary for instructors teaching subjects affecting public health. Since BPPVE was sunset, there is no enforcement of these requirements.

Currently, BAR requires prospective instructors to:

- Be ASE certified in electrical/electronics systems (A6), engine performance (A8) and advanced engine performance (L1),
- Be licensed by BAR as a Smog Check technician,
- Attend a 32-hour training session in instructional techniques taught by BAR staff, and,

- Receive a passing evaluation of a live training demonstration where the prospective instructor delivers a training module on a subject selected from a menu of subjects.

This process relies on ASE certification and BAR licensure to establish automotive technical expertise. Currently, there is a 60% failure rate of instructor candidates. The primary cause of failure is a lack of technical expertise.

### AUDIT PROCESS FOR TRAINING INSTITUTIONS

California Code of Regulations (CCR) 3340.32 lists requirements to license training institutions. Each training institution is required to provide a list of equipment, allowing BAR staff access to facilities and records for inspection; and, to follow BAR recommendations to change methods of instruction and administration of examinations. Audits should be conducted to verify requirements related to instructor quality, course length, materials use and availability, lesson plan, mandated laboratory demonstrations, exercises, examinations, final examination security procedures, and required equipment. The current auditing process would likely be resource intensive because of class length, required expertise of auditors, geographic spread of institutions, and existing methods to conduct the audit.

## PURPOSE OF THE STUDY

The purpose of the study was to provide an independent assessment of current and proposed training strategies in order to identify options that will better meet its training needs.

# SECTION 2: RESEARCH STRATEGY

GENERAL APPROACH

In order for the study to be thorough and objective, Comira gathered information about BAR's technician training program from multiple sources: BAR staff, certified instructors at BAR certified training programs, persons who employed Smog Check technicians (station owners/supervisors of private fleets), and practicing Smog Check technicians in the field to gain an understanding of the industry.

UTILIZATION OF EXPERTS

Throughout the project, Comira consulted with BAR staff familiar with Smog Check technician training, educators at private and public BAR certified training programs, and licensed Smog Check Technicians to obtain information about BAR's technician training program.

APPLICABLE PSYCHOMETRIC STANDARDS

The Standards for Educational and Psychological Testing (1999) set forth by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education serve as the standards for evaluating of all aspects of credentialing, including professional and occupational credentialing. The Standards are used by the measurement profession as the psychometric standards for validating all examinations, including licensing and certification examinations. The Standards use the term "test" broadly and include credentialing procedures as well as actual tests.

Therefore, Standards 14.8, 14.10, and 14.14 apply directly to the foundation of the BAR's training program as well as all procedures and examinations.

Standard 14.8 states:

*"Evidence of validity based on test content requires a thorough and explicit definition of the content domain of interest. For selection, classification, and promotion, the characterization of the domain should be based on a job analysis (p. 160)."*

> Application to BAR's training program. Subject matter areas covered in the examination must be based on the results of an occupational (job) analysis of current practice. The results of the job analysis also apply to the rationale for including specific topics in training courses prior to and after licensure.

Standard 14.10 states:

*"When evidence of validity based on test content is presented, the rationale for defining and describing a specific job content domain in a particular way (e.g., in terms of tasks to be performed or knowledge, skills, abilities or other personal characteristics) should be stated clearly (p. 160)."*

> Application to BAR's training program. The rationale for candidate qualifications to enter the training program (experience and education) and the rationale for teaching specific subject matter in training courses must be based on sound validity evidence from occupational (job) analysis and from data obtained from subject matter experts.

Standard 14.14 states:

*"The content domain to be covered by a credentialing test should be defined clearly and justified in terms of the importance of the content for credential-worthy performance in an occupation or profession. A rationale should be provided to support the claim that the knowledge or skills being assessed are required for credential-worthy performance in an occupation and are consistent with the purpose for which the licensing or certification program was instituted (p. 161)."*

> Application to BAR's training program. Subject matter covered in the examination should be covered in proportion to importance to practice (percentage of questions). Such proportions are obtained directly from the results of an occupational (job) analysis. Since the purpose of the examination is to identify candidates who possess the minimum training and education, the subject matter covered on the examination must be relevant to actual practice.

Standards 3.15, 3.22 and 3.23 apply directly to performance examinations.

Standard 3.15 states:

*"When using a standardized testing format to collect structured behavior samples, the domain test design, test specifications and materials should be document as for any other test. Such documentation should include a clear definition of the behavior expected of the test takers, the nature of the expected responses, and any materials or directions that are necessary to carry out the testing (p. 46)."*

> Application to BAR's training program. When designing performance examinations, e.g., hands-on exercises, the examination should be designed such that test takers are required to demonstrate those skills in settings that closely resemble real-life settings. The tasks in the performance examination as well as the scoring criteria should be clearly defined and documented.

Standard 3.22 states:

*"Procedures for scoring, and if relevant, scoring criteria should be presented by the test developer in sufficient detail and clarity to maximize the accuracy of scoring. Instructions for using rating scales or for deriving scores obtained by coding, scaling or classifying constructed responses should be clear. This is especially critical if tests can be scored locally (p. 47)."*

> Application to BAR's training program. When designing standardized scoring criteria for performance examinations, the criteria should be defined in sufficient detail as to maximize reliability of ratings for all examiners.

Standard 3.23 states:

*"The process for selecting, training, and qualifying scorers should be documented by the test developer. The training materials, such as the scoring rubrics and examples of test takers' responses that illustrate the levels on the score scale and the procedures for training scorers should result in a degree of agreement among scorers that allow for the score to be interpreted as originally intended by the test developer. Scorer reliability and potential drift over time in raters' scoring standards should be evaluated and reported by the person(s) responsible for conducting the training session (p. 47-48)."*

> Application to BAR's training program. There should be formal training for all examiners so that the candidates' responses are scored according to the same standards. Scorer reliability should be monitored regularly to ensure candidates receive the same examination experience.

JOB COMPONENT APPROACH

A job component approach was used to examine the Smog Check program. The approach is predicated on the assumption that any given job component or activity occurring in substantially the same form in different jobs would have the same requirements (McCormick, 1959; McCormick, 1976, p. 689). The approach requires justification of the use of a selection procedure based on demonstrated validity of inferences from one or more domains of work (job components). Components of the job are identified and their interrelationships are established. The idea is to demonstrate evidence for generalized validity of inferences based on sources of competencies and then use subsets of the sources for credentialing persons in the new situation.

Job component validation was selected for this study because its approach is best suited for situations in which undue dependence on subjective evaluations should be avoided and it is not possible to identify predictors for statistical evaluation (McCormick, 1976).

FRAMEWORK FOR JOB COMPONENT APPROACH

The job components and their interrelationships form the basis of a nomological network. Here, the nomological network maps the relevant competencies, required competencies, and acquired competencies, and the interrelationships among and between them (Cronbach & Meehl, 1955).

In this approach, the framework can be conceptualized as two intersecting circles in which there is a "person" side of the equation and a "job" side of the equation.

The "person" side of the equation involves competencies that candidates would have acquired prior to licensure:

- Coursework and training in Smog Check inspections
- Training and experience required for technician licensure
- ASE certification

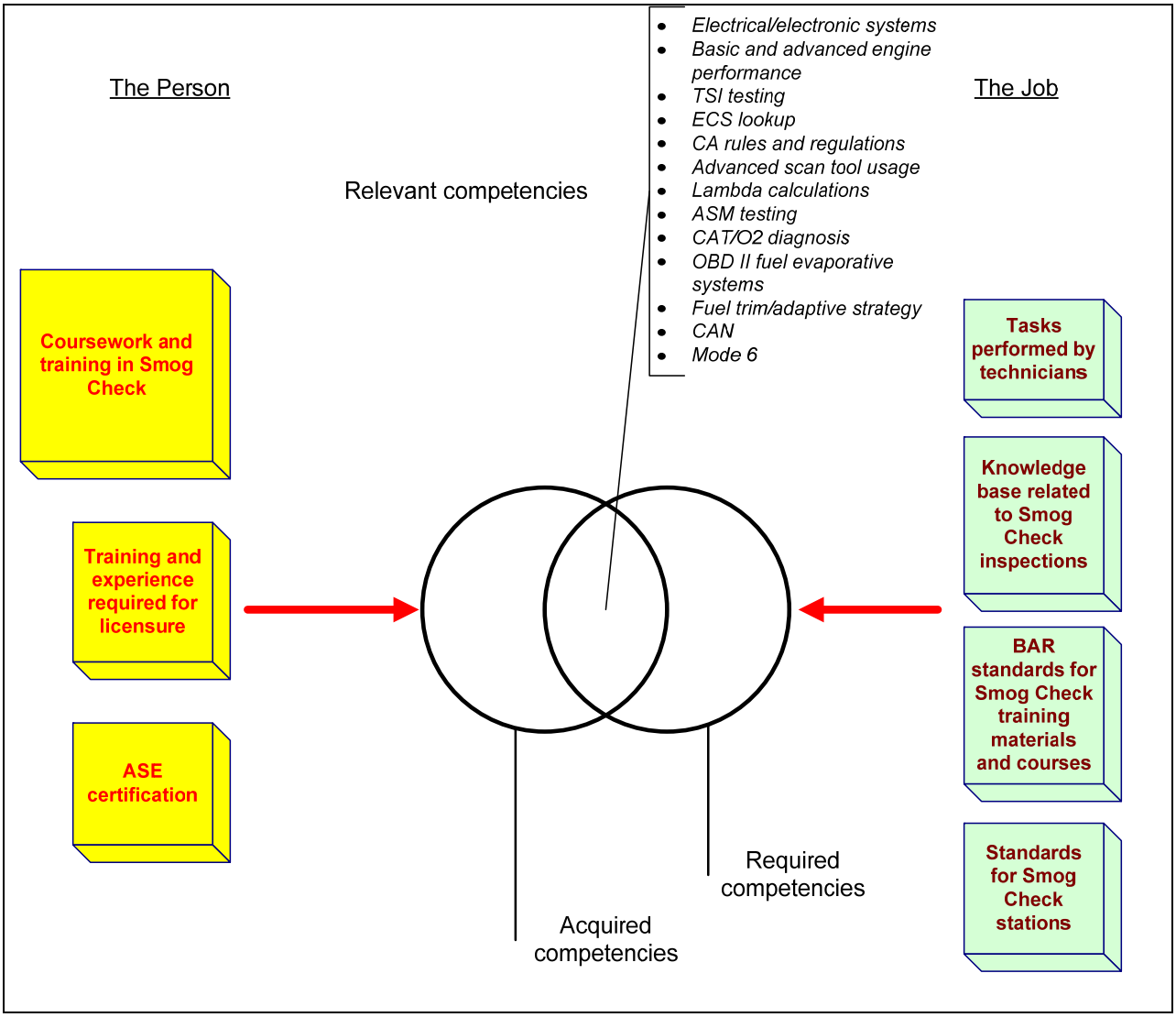
The "job" side of the equation includes what competencies are required to perform Smog Check inspections:

- Tasks performed by Smog Check technicians
- Knowledge base to perform Smog Check inspections
- BAR standards for Smog Check training courses and materials
- BAR standards for Smog Check stations

The person (acquired) and job (required) frameworks of the competencies in Smog Check training are illustrated in Figure 1.

Given this framework, we conceptualized the relevant competencies for performing Smog Check inspections to be the intersection of the acquired and required competencies. The implication is that the competencies of interest (Smog Check training strategies) are related to multiple dimensions that involve technician education and training, and, tasks performed and knowledge used on the job.

Figure 1 – Theoretical framework for Smog Check training




## DATA SOURCES

As highlighted in the theoretical model in Figure 1, there were several types of data necessary to conduct the independent assessment of BAR's current training program.

### SITE VISITS

Comira toured Smog Check training institutions (community colleges and private facilities) and Smog Check stations to solicit information about Smog Check equipment, inspections and technician knowledge.

## INTERVIEWS

Instructors at community colleges and private training facilities were interviewed to solicit information regarding how training courses and hands-on exercises are implemented. Comira solicited information regarding students who took Smog Check training courses, how Smog Check materials were integrated into the curriculum, and issues related to student preparedness for working in the industry upon graduation.

## 2006 OCCUPATIONAL ANALYSIS

The job tasks in the 2006 occupational analysis were evaluated to determine if there were tasks that were specific to technicians who work in test-only stations.

## WORKSHOPS

Workshop #1: A focus group of educators and technician-owners was convened to discuss the relationship of training to technician job performance. Comira solicited input from educators and technician-owners with regard to effectiveness of the Smog Check training program, Smog Check course content, course formats (lecture, hands-on exercises), strengths and weaknesses of technician training, challenges faced by instructors, and suggestions for improving course curriculum.

Workshop #2. A focus group of subject matter experts, including educators and BAR staff, was convened to identify the tasks and knowledge that entry-level Smog Check technicians were expected to know at the time of licensure. The BAR staff had extensive experience in Smog Check Program curriculum and enforcement issues related to Smog Check technicians. The focus group re-evaluated and refined the task and knowledge statements derived in a 2006 occupational analysis of Smog Check technician practice. The goal was to eliminate redundancies in the statements and refine the wording so that the job tasks and knowledge reflected entry-level practice of Smog Check technicians. In essence, the panel performed a “tabletop” (focus group method) occupational analysis to identify critical job tasks and knowledge base necessary to perform the duties of Smog Check technicians.

There were two purposes for conducting the tabletop occupational analysis:

- The first purpose was to validate job content and ensure that training reflects when competence in specific tasks was acquired during industry experience or from required coursework prior to licensure and when competence in specific tasks was acquired during industry experience or from update training after licensure. The tasks were used as the foundation of a needs analysis questionnaire.

- The second purpose was to validate the knowledge necessary to perform job tasks.

## SURVEY QUESTIONNAIRES

Comira conducted four surveys of relevant stakeholders (instructors, technicians, station owners/supervisors) and reviewed BAR's Vendor Specifications for Bureau Training Program to obtain the desired information.

Survey #1: Smog Check Program Training Survey for BAR certified instructors. Approximately 300 instructors were notified by email to access the survey on Comira's online survey system. Once on the Comira website, they were instructed to obtain a unique username and password, and complete the survey. The instructors' usernames and passwords were linked to each instructor's email address and could not be used after the respondent submitted his completed survey.

In this survey, instructors were asked questions about their teaching experience, work setting, supplemental training taken, their views regarding current curriculum, areas for which students needed in-depth training, obstacles to teaching, and actions that BAR could take regarding the training program and course content. The full text of the questions and a summary of the group data are presented in Appendix A.

Survey #2: Smog Check Program Training Survey for new Smog Check technicians. The technician survey was sent by mail to 1,704 licensed technicians who had up to 2 years of licensed experience. The technicians were instructed to complete the survey and return it to Comira's Folsom office in a stamped, self-addressed envelope.

In this survey, technicians were asked about their training institution, prelicensure experience, Smog Check training courses, and whether there was need for additional training modules to adjunct their training. The full text of the questions and a summary of the group data are presented in Appendix B.

Survey #3: Owner/Supervisors' Assessment of Smog Check Technician Knowledge. Eighteen hundred and seventeen technician-owners or supervisors of private fleets were notified by mail. Of the 1,817 individuals, 666 were technician-owners of test-only stations. The individuals were instructed to use a unique username and password printed on a cover letter to access the survey on Comira's online survey system.

In this survey, a sample of technician-owners or supervisors of private fleets were asked about their facility, technician-employees, and the strengths and weaknesses of technician knowledge. The full text of the questions and a summary of the group data are presented in Appendix C.

Survey #4: Smog Check Technician Training Needs Assessment questionnaire. Three hundred twenty-eight technicians were sent a questionnaire by mail. The technicians represented all levels of experience with emission-related repairs. The technicians were instructed to complete the survey and return it to Comira's Folsom office in a stamped, self-addressed envelope.

In this survey, technicians were asked about their training and their experience before and after completing BAR courses. They were also asked to rate 66 tasks (developed in Workshop #2) that were organized in terms of nine content areas, e.g., vehicle inspection, emission test procedures, visual inspection, functional tests. A rating of 1 or 2 indicated that competency in the task was acquired during industry experience or required coursework before licensure. A rating of 3 or 4 indicated that competency in the task was acquired during industry experience or training after licensure. The full text of the questions and a summary of the group data are presented in Appendix D.

### STUDENT ENROLLMENT STATISTICS

Information regarding course enrollment and licensing trends in Smog Check courses (CY 2004 through 2007).was obtained from BAR's Standards and Training website.

### CANDIDATE EXAMINATION DATA

Candidate test data was obtained from the Department of Consumer Affairs' test delivery vendor to obtain pass/fail data from students who completed coursework at community colleges, private training institutions, and Regional Opportunity Programs (ROP)/high school/adult education programs.

An item analysis report of candidate test data conducted by the Department of Consumer Affairs' Office of Examination Resources for the Advanced Emissions (EA) examination (June 1, 2007 to March 31, 2008) was also provided.

### PROPOSALS FOR RESTRUCTURING PROGRAM

Two proposals were examined. The first proposal was submitted in February 2007 by BAR's Ad Hoc Educational Advisory Committee (AHEAC) to restructure BAR's existing training program within the framework of BAR's current A6, A8, L1, Basic Clean Air Car Course (BCACC) and Advanced Clean Air Car Course (ACACC).

The second proposal was submitted by BAR to the National Automotive Technicians Education Foundation (NATEF) to create a training course and certification categories for California to encompass existing BAR alternative courses for A6, A8 and L1.

### TEXTBOOK APPROVAL PROCESS

BAR staff and certified instructors were consulted to obtain information about the textbook approval process. A document entitled "Vendor Specifications for Bureau Training Program" was reviewed to obtain information about the textbook approval process.

# SECTION 3: PROFILE OF SURVEY RESPONDENTS

## SURVEY RESPONSE RATES

One-hundred eighteen (118/298 or 39%) BAR certified instructors completed the instructor training survey. Of the 118 instructors, 30 instructors reported teaching 1 to 3 courses and 25 instructors reported that they had not taught in the past two years. The remaining instructors reported teaching four or more BAR certified courses. Only the data for 63 instructors who taught four or more courses are displayed in Appendix A.

Four hundred (400/1,646 or 24%) recently licensed Smog Check technicians completed the technician training survey. Fifty-eight (58) surveys were returned to BAR as undeliverable.

Four hundred forty-seven (447/1,796 or 24%) technician-owners/supervisors completed the assessment of technician knowledge survey. Twenty-one notifications were returned as undeliverable. There were 25 requests for a paper copy of the survey from owners/supervisors who had difficulty accessing the online survey or who did not use a computer at home. Of the 25 requests, 21 technician-owners/supervisors returned the survey.

Eighty-five (85/323 or 26%) technicians completed the needs assessment questionnaire. Five were returned as undeliverable.

## RESPONDENT DEMOGRAPHICS

### Smog Check Program Training Survey (instructors)

Below are the demographics for instructor respondents:

- Approximately 40% had more than 10 years of experience
- Virtually all (62/63) had taught the BAR certified courses in the last four years, e.g., BAR update training course, Advanced and Basic Clean Air Car Courses, BAR Alternative courses for A6, A8, and L1, etc.
- Fifty-eight percent (58%) taught their courses at a community college
- Approximately 40% received 20 to 50 hours of supplemental training in engine, performance/emission diagnostics
- Fifty-seven percent (57%) reported engaging in hands-on training 21 to 30% of the time
- Forty-six percent (46%) of the instructors taught 8 to 12 classes in the past year.

Smog Check Program Training Survey (newly licensed technicians)

Below are the demographics for technician respondents:

- Over one-third (35%) were 35 to 50 years of age
- One hundred and ninety-two technicians received their BAR training at a private vocational school
- One hundred eighty-two technicians received their BAR training at a community college
- Fifty-four percent (54%) were currently employed at a test and repair station
- Forty-one percent (41%) had been licensed 1 to 2 years and 25% had been licensed 6 months to 1 year
- Thirty-eight percent (38%) had more than 5 years of automotive experience prior to starting their first BAR course
- Forty-three percent (43%) completed more than 5 automotive courses prior to starting their first BAR course,
- Seventy-five percent (75%) completed the BAR Alternative course in advanced engine performance
- Twenty-one percent (21%) reported that they had not taken any automotive training course prior to starting their first BAR course
- Nearly 57% of the technicians reported that they had less than one year of automotive trade experience prior to taking their first BAR course
- Seventy-six percent (76%) had not used the Internet for individual learning purposes in non-BAR training courses
- Sixty-seven percent (67%) had not used the Internet for distance learning for non-BAR training course

Owner/Supervisors' Assessment of Technician Knowledge

Below are the demographics for owner/supervisor respondents:

- Fifty-five percent (55%) worked at a test and repair facility
- Thirty percent (30%) had been performing Smog Check inspections 1 to 5 years, 17% had been performing Smog Check inspections for 6 to 9 years, and 32% had been performing Smog Check inspections for 10 to 20 years
- Half of the respondents were one-person shops while 40% employed 1 to 2 additional technicians
- Seventy-six percent (76%) had a computer that technicians actively used to access the Internet to obtain information from manufacturer websites or online resources

Of the stations that provided emission-related repairs, it should be noted that the number of Smog Check repairs performed monthly varied greatly.

Technician Training Needs Assessment

Below are the demographics for technician respondents:

- Fifty-four percent (54%) received their training at a private vocational school while 47% received training at a community college
- Nearly 90% reported obtaining the greatest amount of experience in emission-related inspections and/or repairs at a licensed test and repair facility
- Seventy-six percent (76%) had 11 or more years of training as a licensed Smog Check technician
- Almost all held ASE certifications for A6 (N=72), A8 (N=75), and L1 (N=67)
- Fifty-four percent (54%) had more than 5 years of automotive experience prior to starting their first BAR course
- Thirty-six percent (30%) had completed more than 5 automotive courses prior to starting their first BAR course
- Forty-six technicians completed the L1 alternative, 31 completed the A8 alternative, and 33 completed the A6 alternative

# SECTION 4: PROPOSED INITIATIVES

CONTRACT OBJECTIVE "A"

> "*Evaluate BAR's current training strategy in light of proposed initiatives. Compare Ad Hoc Educational Advisory Committee (AHEAC) proposal, BAR's proposed NATEF training course alternatives, and other identified options for accomplishing basic automotive technology training for entry-level Smog Check technicians*."

KEY FINDINGS

CURRENT LICENSING STRATEGY

Appropriateness of current licensing strategy. BAR's current licensing strategy, which might best be described as "one size fits all," because it requires all technicians to complete emissions-related courses and pass a licensing examination that includes questions on vehicle inspection as well as diagnosis and repair. This strategy does not appear to be appropriate for the portion of the licensee population that only performs inspections. It is likely that upcoming program changes (e.g., diesel vehicle inspection) and some changes under consideration (e.g., OBD only testing), will further undermine the current licensing strategy if not changed.

On the other hand, because many, if not most, of California Smog Check technicians are employed in one-person shops, BAR training is under pressure to produce journey-level technicians skilled in diagnosis and repair, without the benefit of apprenticeship or mentorship programs. If more diagnostic and hands-on training for EA technicians were provided, repair effectiveness is likely to improve. However, cost considerations and pressures from those who perform inspections only prevent the expansion of training from beyond the current requirement of 168 hours.

Change in licensee demographics. Program dynamics and marketplace needs that impact BAR's training of Smog Check technician candidates are changing. At present there appears to be an oversupply of Smog Check technicians. According to statistics based on state licensing examinations and course enrollment gathered from 2004 to 2007, the number of technician candidates attending BAR core courses dropped significantly. For example, candidates enrollment in BAR A6 Alternative was 3,342 in 2004 but 2,253 in 2007. Similarly, enrollment in the Advanced Clean Air Car Course was 3,837 in 2004 but only 2,281 in 2007. During the same period, 4,385 out of 6,910 (63.5%) Smog Check technician candidates passed the state licensing examination.

Of this total, 97.56% (6,296) were licensed as EA technicians and only 2.44% (157) were licensed as Basic Area (EB) technicians. Considering the limited number of candidates seeking an EB license, and the difference between an EB and an EA technician is approximately 10 to 12 hours of additional course work (ASM inspections, NOx diagnostics), the EB license type should be phased out.

Two-tiered licensing system. The most direct support for a two-tiered licensing system comes from the evaluation of the 2006 occupational (job) analysis of Smog Check Technician practice. The results from the 2006 occupational analysis identified the content domains for Smog Check Technicians working in test-only stations.

The results from the 2006 occupational analysis indicated that inspection only technicians did not perform tasks related to "Diagnosis" and "Performing and Verifying Repairs." It is problematic to require technicians to be examined on tasks that are not part of their job. The defensible process is to design examination for particular jobs. The 2006 occupational analysis does not support examining inspection only technicians on "Diagnosis" and "Performing and Verifying Repairs."

It is noteworthy that during the process of revising the tasks from the 2006 occupational analysis for the needs assessment questionnaire (Survey #4), focus group participants concluded that there were significant gaps in content coverage of practice that were likely to affect the content assessed on the licensing examination. It is also noteworthy that the revised list of tasks was useful for establishing when (prior to or after licensure) technicians acquired competencies; however, the list of tasks did not adequately capture the skill level necessary to perform inspection only vs. diagnosis and repair.

AD HOC EDUCATIONAL ADVISORY COMMITTEE (AHEAC) PROPOSAL

The proposal submitted in February 2007 by AHEAC for revising and updating BAR's existing training program that culminates in licensure indicated that BAR and a committee of educators work within the existing framework to realign some topics, update subject content and revamp course hours.

Under the proposal, the combined course length for the A6, A8, and L1 courses (renamed Phase I, II, and III) would be increased to 108 hours (up from the 72 hours that are now minimally required). The combined course length for the Basic and Advanced Clean Air Car Courses would be reduced to 80 hours (down from the 96 hours that are now minimally required). Thus, the total hours of training for an EA technician would increase from 168 to 188.

The AHEAC proposal provides a clear list of subject areas and topics to be covered in each course, and includes a preset minimum number of hours for laboratory work and homework assignments. Overall, the restructuring attempts to address the need to increase hands-on experience. The proposal indicates that ASE certification would not be accepted in lieu of Phase III (L1) training for initial Smog Check Technician licensing, due to the increased emphasis in the Phase III course on hands-on assignments. The

AHEAC plan requires participants in the Phase III course to satisfactorily complete all laboratory assignments to be eligible for taking the course examination.

The AHEAC proposal contains many elements that merit consideration. However, it does not address a basic structural problem in the current program and that is the disparity between the knowledge and skills required for a technician who only conducts inspections and one that performs diagnosis and repairs.

### BAR'S PROPOSAL TO NATEF

The proposal submitted by BAR to the National Automotive Technicians Education Foundation (NATEF) asks NATEF to create two new certification categories to cover driveability and emissions. If NATEF creates the new certification categories, BAR proposed requiring all applicants seeking initial Smog Check licensure to complete the NATEF new certifications that encompass the A6 (diagnosis and repair of emission-related electrical/electronic systems), A8 (diagnosis and repair of emission-related engine performance systems), and L1 (diagnosis and repair of emission-related advanced engine performance systems) certifications.

Existing licensees seeking renewal would still be able to use ASE certifications to renew their Smog Check license. BAR would accept NATEF certifications from the new certification categories from applicants attending any NATEF certified school. BAR would no longer design, develop, approve, and/or administer courses for California that specialize in intermediate electrical/electronic systems, intermediate engine performance systems, and advanced engine performance systems.

There are currently 44 BAR certified training institutions (36 community colleges and 8 private institutions) which are also certified by NATEF. BAR recognized that NATEF has rigorous standards for certifying schools including standards for program goals, program administration, learning resources, finances, student services, instruction, equipment, physical facilities, and instructional staff. NATEF also requires prospective institutions to provide documentation of certification standards and to undergo a two-day site visit, in addition to an initial "self evaluation" process and are subject to a one-day evaluation during the midpoint of the five-year certification period.

However, there are several concerns if initial applicants were required to complete the two NATEF courses. The major concern is that the number of class hours required to complete each NATEF course exceeds 200 hours, or roughly 10 times the length of BAR's Alternative courses for A6 and A8. Another concern is that NATEF certification is only offered twice a year. Finally, if schools were required to purchase additional tools and equipment to pass the NATEF evaluation, there is a concern that an unacceptable financial burden would be placed upon school resources.

## RECOMMENDATIONS

RECOMMENDATION A1. Re-engineer BAR's Training Program to better accommodate inexperienced technicians by establishing a sequentially progressive training track.

Identify experienced/highly-trained technicians by developing a process for assessing knowledge, skills and abilities prior to training and only mandate training necessary relative to the candidate's knowledge, skills and abilities. BAR should accept existing nationally recognized automotive training, certification and degree standards such as National Institute for Automotive Service Excellence (ASE) certifications, National Automotive Technician Education Foundation (NATEF) accredited training programs, and recognized degree programs.

RECOMMENDATION A2. Conduct an occupational (job) analysis to identify the tasks performed and the knowledge base for technicians who perform inspections. The premise for an examination should be based on the results of an occupational analysis to identify the tasks performed and the knowledge skills, and abilities necessary to perform effectively.

The results of the occupational analysis will serve as the foundation for an examination that measures competencies required to conduct inspections but not perform emissions-related repairs.

RECOMMENDATION A3. Create a two-tiered system for applicants seeking initial licensure. This would involve creating a new licensure program for persons who performed inspections only. *(May need regulatory change)*

Two license types would be created: a license for conducting Smog Check inspections, and a license for performing diagnosis and repairs. The Emissions Inspection Technician license would require minimal training in engine performance and would focus on the laws and requirements of the Smog Check Program as well as the skills required to perform Smog Check inspections. The Emissions Diagnostic and Repair Specialist license, which requires an Emissions Inspection Technician license as a prerequisite, would require training in electrical/electronics, and advanced engine performance and driveability, or their educational or certification equivalent.

RECOMMENDATION A4. Create a transition period of one or two years prior to biennial renewal, in which persons who do not possess the ASE driveability certification, for example, would be required to obtain certification if they seek to obtain an Emissions Diagnostic and Repair Specialist license.

RECOMMENDATION A5. Stop licensing new EB technicians after December 31, 2009 and require existing EB technicians to successfully complete additional coursework (ASM inspections, NOx diagnostics prior to accepting positions in Enhanced Areas, as appropriate. *(May need regulatory change)*

# SECTION 5: TRAINING AND EXAMINATION

CONTRACT OBJECTIVE "B"

> *"Assess, validate and make recommendations on BAR's practices relative to Smog Check technician training and examination as a prerequisite to biennial licensure renewal."*

KEY FINDINGS

Adequacy of training for performing emission-related repairs. Of the 400 Smog Check technicians (Survey #4), 82% "agreed" or "strongly agreed" with the statement that "Overall, the BAR Training that I received qualified me to perform emission-related repairs." It should be noted that many of the same technicians also stated that they would have benefited from additional hands-on training in emission-related diagnosis and repair. This data contrasts with 31% of the instructors (Survey #1) who indicated that BAR training adequately prepared students to diagnose vehicle emission failures or perform Smog Check inspections.

First-time and repeat test takers. An analysis of candidate data furnished by Consumer Affairs' test delivery vendor indicated that nearly 63.5% of all Smog Check candidates during the period 2001 to 2006 passed their initial examination for licensure. While a 63.5% pass rate is well within the range of acceptability for a professional licensing examination, BAR has reported a lower pass rate (51.7%) over the last four years for Smog Check candidates taking the state licensing examination. The lower pass rate is likely influenced by candidates who took the examination multiple times.

Job tasks. Technicians (Survey #4) identified 52 tasks that were likely acquired through industry experience or training prior to licensure (see Appendix F). Of these tasks, many tasks required low to moderate technical skills. Examples of these tasks include:

- Select vehicle gear as prompted by the analyzer during emissions testing.
- Weigh vehicle as prompted by the emissions analyzer to set load of dynamometer.
- Determine if vehicle is required to be tested at a specific type of station (e.g., test-only, Gold Shield).
- Determine accuracy of DMV renewal notice and vehicle information prior to performing smog check inspection (e.g., VIN label, license number).

Technicians also identified 14 tasks that were likely acquired through industry experience or training following licensure. In particular, two tasks required higher level skills:

- Evaluate diagnostic testing results to determine if components of vehicle systems need to be cleaned, repaired, or replaced.

- Inspect analyzer devices to ensure accurate functioning during smog check inspection or replace if needed.

Not all 14 tasks identified as likely acquired through industry experience of training following licensure (see Appendix G) required higher level skills. Rather, these tasks required low to moderate skills. There are several influences that may have impact on the results. First, there were respondents who had 11 or more years of experience (76%). Second, 23% of the respondents indicated that they had not taken automotive courses prior the first BAR course. Third, 36% of the respondents indicated that they had taken more than five courses prior the first BAR course.

Job knowledge. During the process of revising the knowledge base from the 2006 occupational analysis for the needs assessment survey (Survey #4), focus group participants concluded that there were significant gaps in content coverage of practice that were likely to affect the content assessed on the licensing examination. While the revised list of knowledge was useful for establishing the knowledge base required to perform tasks on the job, the list of knowledge did not adequately differentiate between the knowledge necessary to perform inspections vs. diagnosis and repair (see Appendix E).

Current curriculum requires overhaul. Most instructors and some technicians commented that the current curriculum does not adequately prepare students to diagnose and repair vehicle emission failures. The data from 63 instructors (Survey #1) included in the analysis support this notion.

- Fifty-two percent (52%) indicated that both curriculum and course hours need to be overhauled.
- The five most important subject areas for which students need in-depth training include:

    - Theory and operations of Emissions Control Systems (N=34)
    - Basic electrical and electronic systems theory (N=33)
    - Advanced electrical/electronic system operations (N= 30)
    - Advanced engine performance (N=29)
    - Diagnosis and repair (N=28)

- Fifty-seven percent (57%) indicated that the time spent on emission-related diagnostic procedures should be significantly increased.

- Eighty-five percent (85%) indicated that an additional training module devoted to emission-related repairs should be added.
- Instructors indicated that curriculum and course materials should be updated and better integrated.

Need for additional training on specific topics. Many technicians (Survey #2) indicated that increased emphasis on specific topics would have benefited them in their job performance. Examples of topics include:

- Step-by-step diagnostic procedures to identify causes of emission failures (N=162)
- Theory and operation of CAN systems (N=137)
- Advanced scan tool usage (N=131)
- Application of Mode 6 (N=128)

Technicians also asked for more hands-on training to prepare them to work in an inspection environment as well as to perform diagnosis and repairs. They commented that hands-on exercises could include actual analysis of data and step-by-step diagnostic procedures.

Data from the instructors (Survey #1) further supported the implementation of additional training devoted to emission-related repairs. When asked "Do you believe an additional training module devoted to emission-related repairs should be added," instructors indicated that a module should be added to cover advanced topics related to emission-related diagnostic procedures and emission-related repairs.

Prerequisites. Instructors, in response to surveys and in workshops and interviews, proposed that BAR consider establishing some level of automotive training or ASE certification as a prerequisite to Clean Air Car Courses, and BAR update training courses. They also proposed that BAR consider requiring the Basic Clean Air Car Course as a prerequisite to the Advanced Clean Air Car Course.

Both instructors and technicians commented that BAR should develop and enforce a selection process to verify student experience. Such a process should include a means to verify a requisite amount of experience prior to admitting the students into BAR courses. If a prospective candidate has experience that cannot be readily documented, BAR should offer an option to challenge the prerequisites on a case-by-case basis. If the candidate's experience/training is extensive, the candidate should have a shorter path to licensure. If a student does not have automotive experience or training, there needs to be an avenue to enter the training program at a basic level.

System of accountability for schools/instructors. Comments from instructor and technicians indicated that BAR should create a system to make schools accountable. The system will require tools and processes to monitor school/instructor performance. The process could employ a variety of factors to rank schools according to student success on the licensing examination (pass rates), available resources (e.g., equipment, facilities), and end-of-course student surveys.

The results should be used as performance indicators to target institutions/instructors for audit. Standards should be developed and adopted for use in the audit process to assess quality of instruction and student outcomes. Underachieving institutions and/or instructors should be subject to remedial or disciplinary measures, including revocation of BAR certification.

BAR should also revise its standards for certifying instructors in a manner that establishes the appropriate level of technical expertise and subject area proficiency. New instructors should be required to complete an instructional basics training course and demonstrate that they possess the necessary competencies and skills to deliver training effectively. Evaluation could include direct observation by a qualified evaluator during classroom training in terms of standardized criteria for technical competence, instructional skills, and overall effectiveness in achieving the learning objectives.

A system of accountability can be accomplished now that BAR has the capability of accessing licensing examination data and school enrollment records by instructors to compare the pass rates on candidate data by school ***and*** instructor. Instructors with low pass rates, as measured by initial Smog Check license examination results, can be identified.

Initial pass rates. Analysis of examination results from technicians, school records, and BAR licensing data indicate there is a significant difference in the pass rate between candidates who trained at California Community Colleges (75%), versus those who trained at private training institutions (58%) or Regional Opportunity Programs/High Schools/Adult Education facilities (55%).

Based on the Smog Check Technician licensing examination results, initial pass rates vary widely between individual schools and instructors. An evaluation of BAR school enrollment and pass/fail data implies that some ineffective schools accept students into the program who should not be admitted (i.e., fail to meet minimum experience or education qualifications), and pass students who do not meet minimum requirements.

Smog Check licensing examination. The primary focus of the current Smog Check Technician Licensing examination is on low level skills. Because these functions represent the majority of tasks in the test specifications, the majority of the questions on the examination cover these topics. Therefore, a candidate could fail all diagnostic and repair-related questions and still pass the examination. BAR's current "one size fits all" licensing strategy may contribute to the possibility that some licensed technicians might not be able to effectively diagnose or repair a vehicle when it fails its Smog Check inspection.

At present, "end-of-course" examinations for BAR courses are administered by the schools and have been used for many years without safeguards for examination security (e.g., backup examinations, schedule for periodic replacement). BAR does not appear to have the resources to develop and maintain credible examinations for BAR

courses. As a result, some schools have 100% of their students pass the course, while the overwhelming majority of their students fail the BAR Smog Check licensing examination.

Internet and distance learning. Data from Survey #2 indicated that the majority of technicians[2] do not use the Internet for instructional purposes (76%) or for distance learning (68%).

- Only 24% of recently licensed technicians have participated in non-BAR training courses that used the Internet for teaching purposes.

- Only 20% claimed to have used the Internet for "distance learning" outside of the classroom setting.

It should be noted that the technicians in Survey #2 had little or no training beyond what BAR required. There is a general trend for vehicle manufacturers and government agencies to use the Internet as it is a cost effective means to disseminate information in a short amount of time.

Lack of automotive experience. There is a wide disparity in experience and skill level of candidates initially entering BAR training. Often, this disparity negatively affected the class learning experience and licensing examination results. It is reasonable to assume that lack of experience for some contributes to improper inspections and ineffective diagnosis and repair.

Twenty-one percent (21%) of the newly licensed technicians in Survey #2 reported that they had not taken any automotive courses prior to their first BAR course. It should be noted BAR has historically attempted to enforce a requirement that as a prerequisite to enrollment in the Clean Air Car Courses the student must have one year of automotive experience or equivalent automotive training courses in the engine performance area, but was unable to do so.

Technicians commented that students who lacked basic automotive training or experience negatively affected class discourse and often wasted time with trivial questions.

OTHER KEY FINDINGS

- The biggest obstacles that instructors (Survey #1) cited when teaching BAR certified training courses were:

  - Beginning students have less automotive experience and knowledge (N=40)
  - Curriculum and course content need to be updated and improved (N=38)
  - Students for whom English is a second language (N=25)

[2] Some technicians did not respond to this item.

- Thirty-eight percent (38%) of newly licensed technicians (Survey #2) reported having more than five years of automotive trade experience and 43% reported having taken more than five automotive courses prior to starting their first BAR course.

- Many technicians commented that there should be a minimum number of hands-on Smog Check inspections on actual vehicles that should be completed prior to completing the training program.

- When asked about the importance of multi-media, e.g., computer-based training, videos, and/or Internet learning materials, instructors were split. Thirty percent (30%) of the instructors indicated that providing multimedia learning materials was least important, while 29% indicated multimedia learning materials was very important.

## RECOMMENDATIONS

RECOMMENDATION B1. Restructure content of courses into modules to allow flexibility in content and course offerings. BAR, working with others, should create a modular format so that older technologies and newer technologies can be presented in perspective, and older technologies or less important topics can be removed and replaced, as appropriate. The modular format should be designed to provide flexibility for schools in processing curriculum changes and adding new program requirements.

RECOMMENDATION B2. Courses should include more exercises involving diagnostic situations that utilize scan tool data and wiring schematics. The diagnostic situations should be designed to teach students to analyze vehicle systems using commonly encountered data.

RECOMMENDATION B3. Incorporate more hands-on exercises in the diagnosis and repair course that involve commonly encountered inspection and diagnostic situations. The exercises should emphasize development of diagnostic skills, use of data and scan tools, and following manufacturer's or other industry-accepted procedures in the process.

RECOMMENDATION B4. Refine standards and procedures for certifying instructors. Technical qualifications should be based on pre-established standards that describe the appropriate level of technical expertise and subject area proficiency.

Prospective instructors, who seek BAR certification, should be required to complete an instructional basics training course and demonstrate that they possess the necessary competencies to deliver training effectively.

Prospective instructors would be required to fulfill technical qualifications to ensure that their experience includes theoretical as well as in-depth practical knowledge of the material (e.g., provide documentation supporting prior education and experience, student evaluations of instructor effectiveness, student evaluations of course content, samples of course examinations, and proof of teaching ability prior to becoming certified by BAR). *(May need regulatory change)*

RECOMMENDATION B5. Develop new procedures to certify and/or audit training institutions and instructors. The procedures should include standardized measures to assess quality of instruction and student outcomes. Underachieving institutions and/or instructors should be subject to remedial or disciplinary measures, including revocation of BAR certification. *(May need regulatory change)*

RECOMMENDATION B6. Develop criteria for identifying underachieving instructors. Each training institution would be responsible for annual or biennial evaluations of certified instructors such that underachieving instructors would be required to take remedial coursework and document improvements that will be implemented in course instruction.

Underachieving instructors would be subject to disciplinary measures, e.g., remedial coursework, documentation of instructor competence, revocation of certification. Initial examinees should be surveyed regarding the quality of instruction obtained from both schools and instructors for all

BAR training courses prior to licensure. Renewal licensees should be surveyed during the application process. Surveys to be conducted electronically through BAR's examination contractor and/or online using BAR's website. *(May need regulatory change)*

RECOMMENDATION B7. Develop a "pass-fail" hands-on ("end-of-course") examination to be administered as part of the final examination at the school. The examination should assess the candidate's competencies to perform emissions-related inspections, diagnosis, and repairs. Develop procedures for administering and scoring the hands-on examination and keeping the examination current and secure.

RECOMMENDATION B8. Develop selection procedures to verify the required amount of experience prior to admitting the students into the Smog Check technician program.

RECOMMENDATION B9. Additional modules devoted to emission related repairs should be added to the training curriculum to better prepare technicians to perform emission-related repairs. The training modules would facilitate different inspection types (OBD II only, diesel, BAR 2010/tailpipe) and the distinction between technicians who perform inspections and technicians who perform diagnosis and repairs. A hands-on examination of student skills should be given prior to completion of inspection technician and diagnosis and repair technician coursework.

# SECTION 6: TEXTBOOKS AND TRAINING MATERIALS

CONTRACT OBJECTIVE "C"

> *"Identify and recommend sustainable and defensible processes and procedures for textbook selection, training material development, and replacement practices and procedures."*

KEY FINDINGS

Textbook approval process. The existing textbook approval process is untenable. Currently, BAR receives textbooks from industry educators and practitioners, who have varying degrees of knowledge, experience, and writing skills. The authors must submit the books and obtain approval from BAR prior to using them in BAR Alternative courses. The Alternative courses are designed to provide the same level of qualification as would be obtained by a technician who obtained ASE A6, A8, and L1 certifications.

Then, BAR staff reviews the textbooks and determines the suitability of the books for use in training programs. BAR staff has prepared a description of the content that should be included in the textbooks and uses the content outline as criteria when evaluating the books.

The content that should be contained in the textbooks for BAR ASE Alternative courses is described in BAR's document, "Vendor Specifications for Bureau Training Program." The content for the textbooks are specified as Required Reading Topics. Broad categories and specific topics for training courses which should be included in the textbooks are shown in Table 3.

Table 3 – Topics to be included in textbooks

| Topic | Subtopics |
|---|---|
| Electrical/electronic systems | • Diagnosing electrical problems using wiring diagrams<br>• Voltage drop<br>• Diagnosing and repair of open circuits, shorted circuits, grounded circuits, intermittents |
| Engine performance diagnosis and repair | • Evaluate/analyze HC, CO, $CO_2$ and $O_2$ gas readings<br>• Diagnose ignition-related problems using oscilloscope/engine analyzer<br>• Analyze engine-related mechanical problems using vacuum gauge results, compression test results |

| Topic | Subtopics |
|---|---|
| Advanced engine/emission systems diagnosis and repair | • Development of a systematic approach to diagnosing driveability complaints and emissions related failures<br>• Diagnose and repair driveability problems and emissions failures<br>• Diagnose and repair of malfunctioning ignition system<br>• Diagnose and repair problems due to a malfunctioning feedback carburetor system<br>• Diagnose and repair problems due to a malfunctioning throttle body or port fuel injection system<br>• Diagnose and repair the cause of an evaporative control system emissions failure<br>• Diagnose HC, CO, NOx, $CO_2$, and $O_2$ gas readings during loaded-mode testing |

The most serious problem with the current process is that it is not a simple "go/no-go" process to compare the technical content of the books to the criteria. For example, a book is reviewed for technical content and editorial integrity such that BAR staff are required to provide edits for errors in grammar, spelling and punctuation as well as assist the authors in identifying weaknesses and improving the quality and coverage of the book, e.g., relocating sentences, paragraphs, or sections within a document.

In the current process, BAR staff serves as the editor of submitted textbooks such that authors expect BAR to go beyond identification of content shortfalls. BAR staff are expected to improve the quality and content of the technical material. Thus, if there are any errors in the approved textbook, the writers may challenge BAR staff and they assume that an approved book must be acceptable.

The entire process is typically carried out without educator or industry assistance; thereby placing BAR at risk of appearing subjective and indefensible. BAR staff may not be actively working as automotive technicians or qualified as professional editors so it is not reasonable to expect them to be fully qualified to evaluate the technical content from a subject matter expert's and editor's points of view. Both of these skill sets are needed in order to perform an adequate review. It is one thing to be knowledgeable of automotive technology but quite another to be qualified to review the textbooks from the perspective of an authority.

Role of instructors and SMEs. Most of the instructors (Survey #1) responded that BAR should work with a committee of subject matter experts (SMEs) paid by the state or a committee of educators to make curriculum and course material decisions. In restructuring BAR's curriculum, identifying subject areas and content, and selecting textbooks and materials, instructors responded that BAR and a committee of educators should work together throughout the process.

- When asked the question, "Who should identify subject areas for BAR courses," most of the instructors responded that a committee of SMEs paid by the state (42.9%) or both BAR and a committee of educators (38.1%). Only 1.6% responded that the curriculum should be specified by BAR only.

- When asked the question, “Who should specify the course curriculum for BAR courses,” most of the instructors responded that a committee of SMEs paid by the state (27%) or both BAR and a committee of educators (52.4%). Only 3.2% responded that the curriculum should be specified by BAR only.

- When asked the question, “Who should select and approve textbooks and other resource materials for BAR courses,” most of the instructors responded that a committee of SMEs paid by the state (25.4%) or both BAR and a committee of educators (46%). Only 4.8% responded that only BAR should select and approve textbooks and other resource material.

- When asked the question, “Who should provide the instructor update every two years?” instructors indicated three alternatives: an automotive expert hired by the state (31.7%), a knowledgeable BAR instructor (34.9%) or a combination of BAR and an automotive expert (15.9%). Only 17.5% of the instructors indicated that BAR staff should provide the biennial instructor update courses.

OTHER KEY FINDINGS

- Some of the textbooks submitted for BAR approval have used copyrighted material without permission.

- Both technicians and instructors (Surveys #1 and #2) suggested that BAR implement a process to update the content of the textbooks and media more frequently and include topics related to emission-related diagnostics and procedures rather than focusing on automotive basics learned elsewhere.

- Diagnostic and repair procedures should be presented in a step-by-step manner for a variety of vehicles demonstrating different causes for emission-related failures, problems associated with various gas readings, and various visual failures to aid technician in acquiring skill in diagnosis related to emission-related problems.

- In contrast to other professions, the Smog Check technicians have not established a common base of knowledge with a unifying theme. BAR staff and Industry professionals acknowledged that there is wide variation in the textbooks and related materials. The authors of the textbooks often write on subject matter on which they are most knowledgeable, consequently, textbooks do not provide even content coverage. The authors also have varying opinions on the relative importance of the content that should be included in the books.

## RECOMMENDATIONS

RECOMMENDATION C1. Under BAR's guidance and direction, contract with a single vendor to provide a course curriculum and materials for new vehicle technologies. The publisher should have technical expertise in emissions testing and automotive repair.

The vendor could be a community college automotive engineering department, the Foundation for California Community Colleges, or a private firms such as ASPIRE (Automotive Support Programs for Inspection, Repair and Emissions).

RECOMMENDATION C2. Contract with an automotive expert and/or utilize knowledgeable BAR certified instructors to serve as the primary instructors of the biennial instructor update course.

# SECTION 7: RULES AND/OR MODELS

CONTRACT OBJECTIVE "D"

> *Identify and recommend rules and/or models for BAR to adopt when using Subject Matter Experts (SMEs) and/or Advisory Committees to provide outside expertise. Recommend rules and/or models that include written procedures to ensure participants will not engage in activities that could result in conflicts of interest."*

KEY FINDINGS

Use of a knowledgeable vendor. When establishing course curriculum, developing curriculum standards, and making decisions about course materials, BAR should contract with a single vendor to guide committees of subject matter experts. The vendor should be required to have technical expertise in emissions testing and automotive repair. The vendor's technical editors would be charged with ensuring that textbooks meet publishing standards. The Contract should include fair pricing provisions to ensure that course materials are affordable.

BAR should work closely with a standing committee of subject matter experts and a vendor, experienced in developing performance examinations, to develop hands-on exercises and the procedures for administering and scoring the examination. In this relationship BAR could act in a decision-making capacity to approve or disapprove content and to approve or disapprove the process by which the exercises are implemented and the examinations are administered. Hands-on examinations could be conducted at modular stations so that several students could be tested at the same time.

RECOMMENDATIONS

| | |
|---|---|
| RECOMMENDATION D1. | Require each subject matter expert or vendor to sign a nondisclosure and/or examination security agreement prior to participation in any BAR-sponsored program activity. |
| RECOMMENDATION D2. | Establish steps to be taken if subject matter experts or vendors violate the terms of the nondisclosure and/or examination security agreement. |

RECOMMENDATION D3. Verify that subject matter experts possess valid licenses and have a signed nondisclosure and/or examination security agreement within the past two years prior to participation in BAR-sponsored activities.

RECOMMENDATION D4. Create a database to track subject matter experts, including the names, addresses, and telephone numbers of all experts who sign the nondisclosure and/or examination security agreement.

RECOMMENDATION D5. Contract with a single vendor to design a hands-on "end-of-course" examination that meets BAR's specifications. The vendor should have technical expertise in emissions-related inspections, diagnosis and repairs as they relate to California rules and regulations.

The vendor should be required to have technical expertise in emissions testing and automotive repair. The vendor could be a community college automotive engineering department, the Foundation for California Community Colleges, or a private firm such as ASPIRE.

RECOMMENDATION D6. Under BAR's guidance and direction, contract with a single vendor to guide committees of content experts in developing curriculum, curriculum standards, selection procedures for instructors, and outcome measures for students and training institutions. The vendor should be required to have technical expertise in emissions testing and automotive repair.

# SECTION 8: PROPOSED MODELS

## PROPOSED CRITERIA FOR SELECTING SMES

SME Selection criteria. Relevant stakeholders (instructors, technicians, technician-owners) should be included in all aspects of the decision making process. There are several criteria that should be considered when selecting subject matter experts for focus groups and advisory committees:

- Formal education in BAR training courses, particularly in emission-related courses
- Years of verified experience as a practicing Smog Check technician who routinely performs diagnosis and repair
- Geographic region, e.g., northern, central, southern California
- Type of practice setting, e.g., test and repair, Gold Shield
- Years of experience working with newly licensed Smog Check technicians

## CURRENT MODEL FOR INITIAL LICENSURE

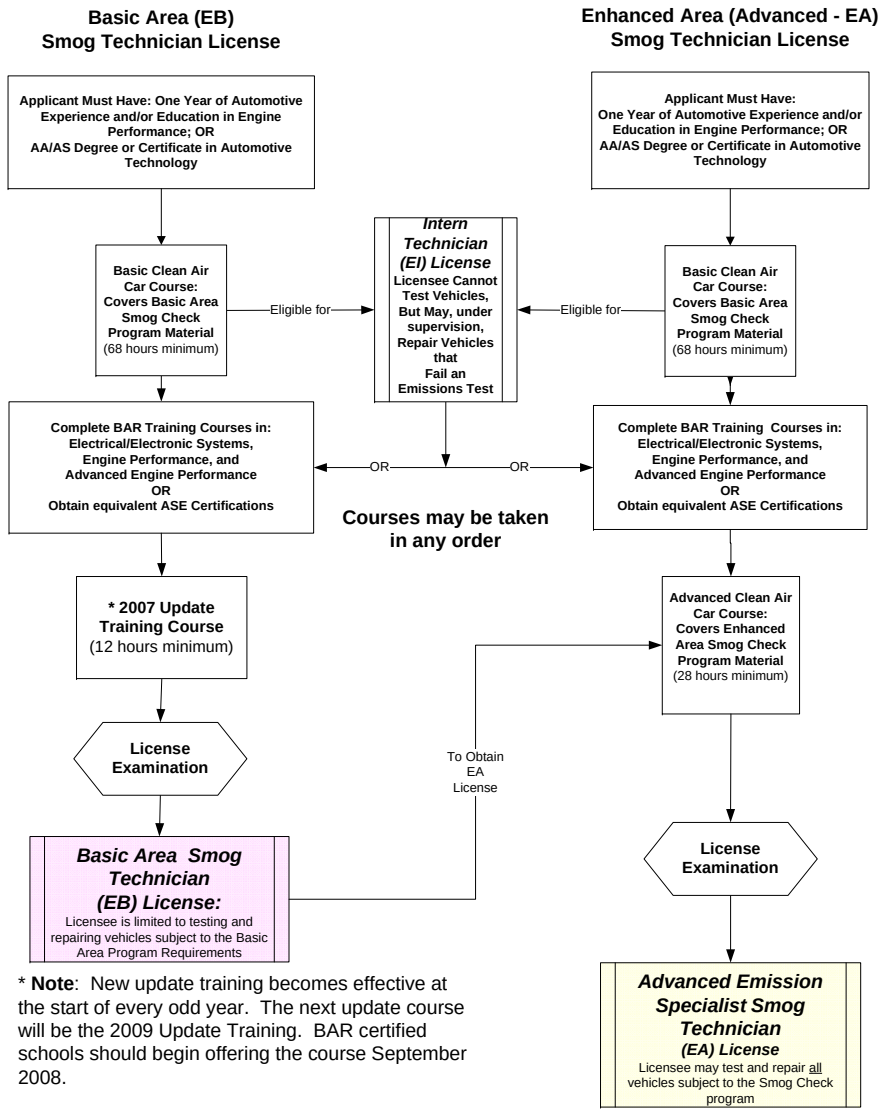
Figure 2 illustrates the current process for candidates who are seeking the Basic Area (EB) and the Enhanced Area (EA) licenses. What distinguishes the EA from the EB license is the requirement to take the Advanced Clean Air Car Course prior to taking the licensing examination.

The model proposes providing candidates in either track to have the option of obtaining an Intern Technician (EI) license, which allows them to repair vehicles that fail an emissions test while under supervision of a licensed Smog Check technician. Technicians may choose to stay in the EB track or take the Advanced Clean Air Car Course and obtain an EA license.

## CURRENT MODEL FOR BIENNIAL RENEWAL

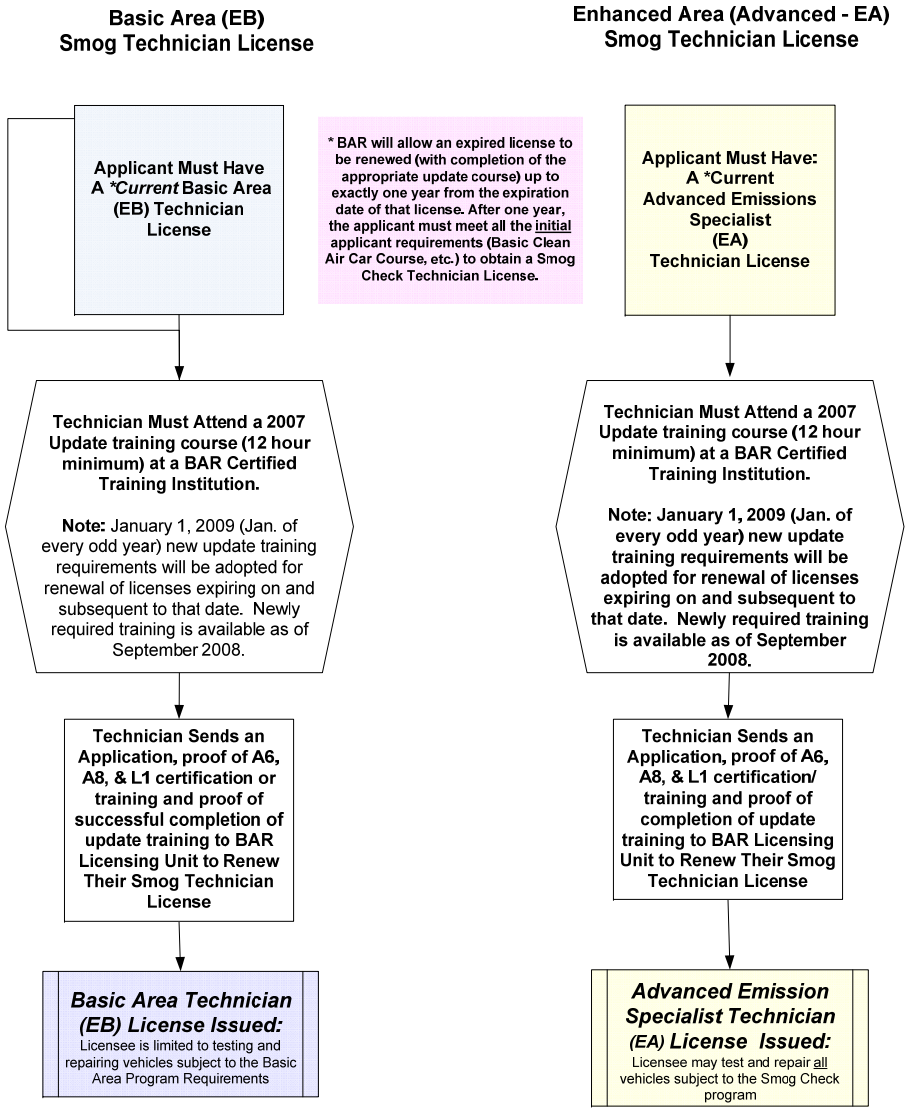
Figure 3 illustrates the current process for candidates who are seeking renewal of their EA or EB license. Both license types are required to hold a current license, take the update course, and provide proof of A6, A8, L1 certification and update training to biennial renewal.

## Figure 2 – Current model for initial licensure




* **Note**: New update training becomes effective at the start of every odd year. The next update course will be the 2009 Update Training. BAR certified schools should begin offering the course September 2008.

## Figure 3 – Current model for biennial renewal

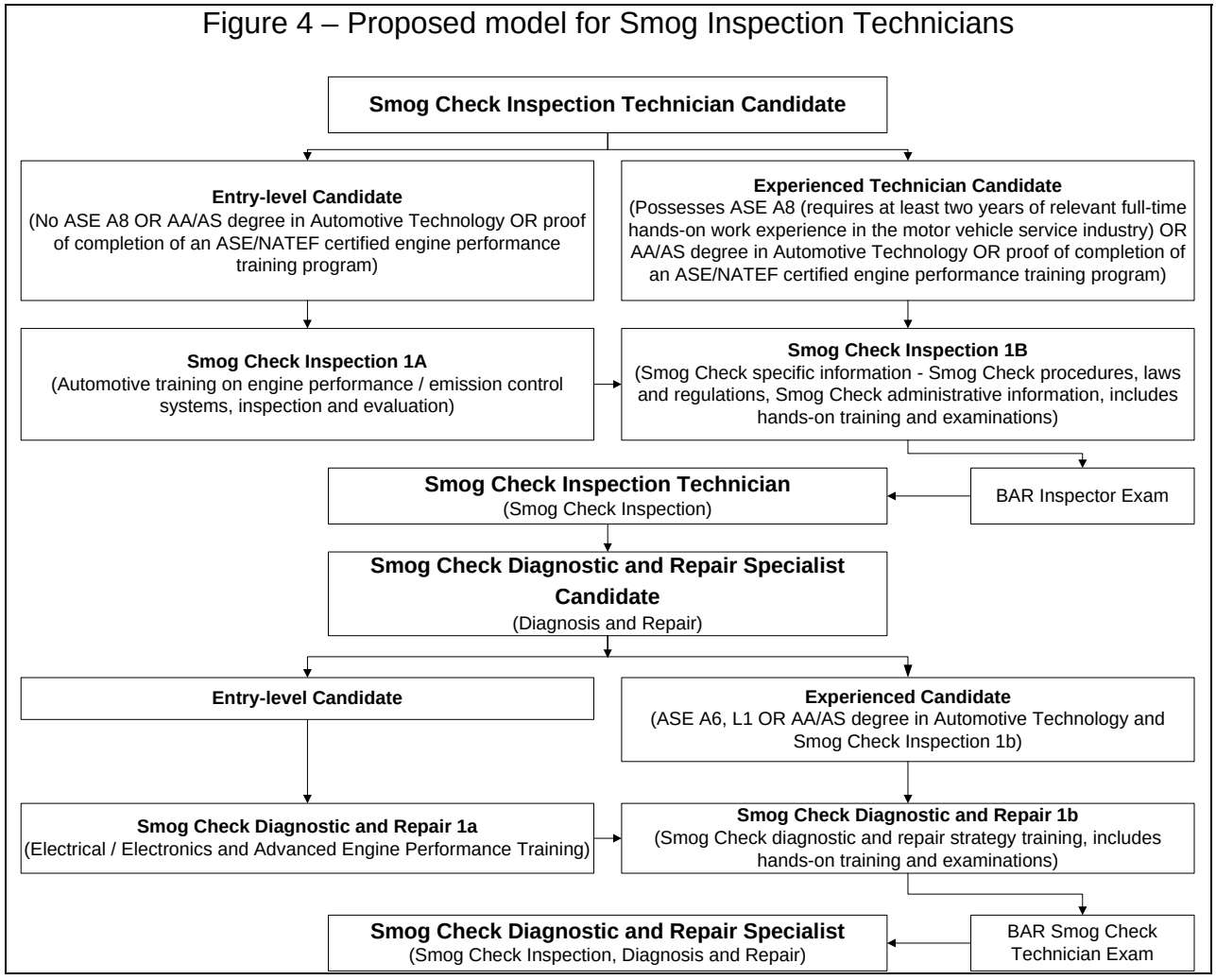


PROPOSED MODEL FOR SMOG INSPECTION TECHNICIANS

Figure 4 illustrates the proposed process for Smog Inspection Technician candidates. The process provides options for those candidates who have no experience and those who have ASE A8, an AA/AS degree, or proof of completion of an ASE/NATEF certified engine performance training program.

In this model, the candidate without experience must take automotive training on engine performance or emission control systems, inspection and evaluation before taking coursework on Smog Check specific information. By contrast, the candidate with experience does not have to repeat automotive training on engine performance or emission control systems, inspection and evaluation and can go directly into coursework with Smog Check specific information.

Figure 4 – Proposed model for Smog Inspection Technicians

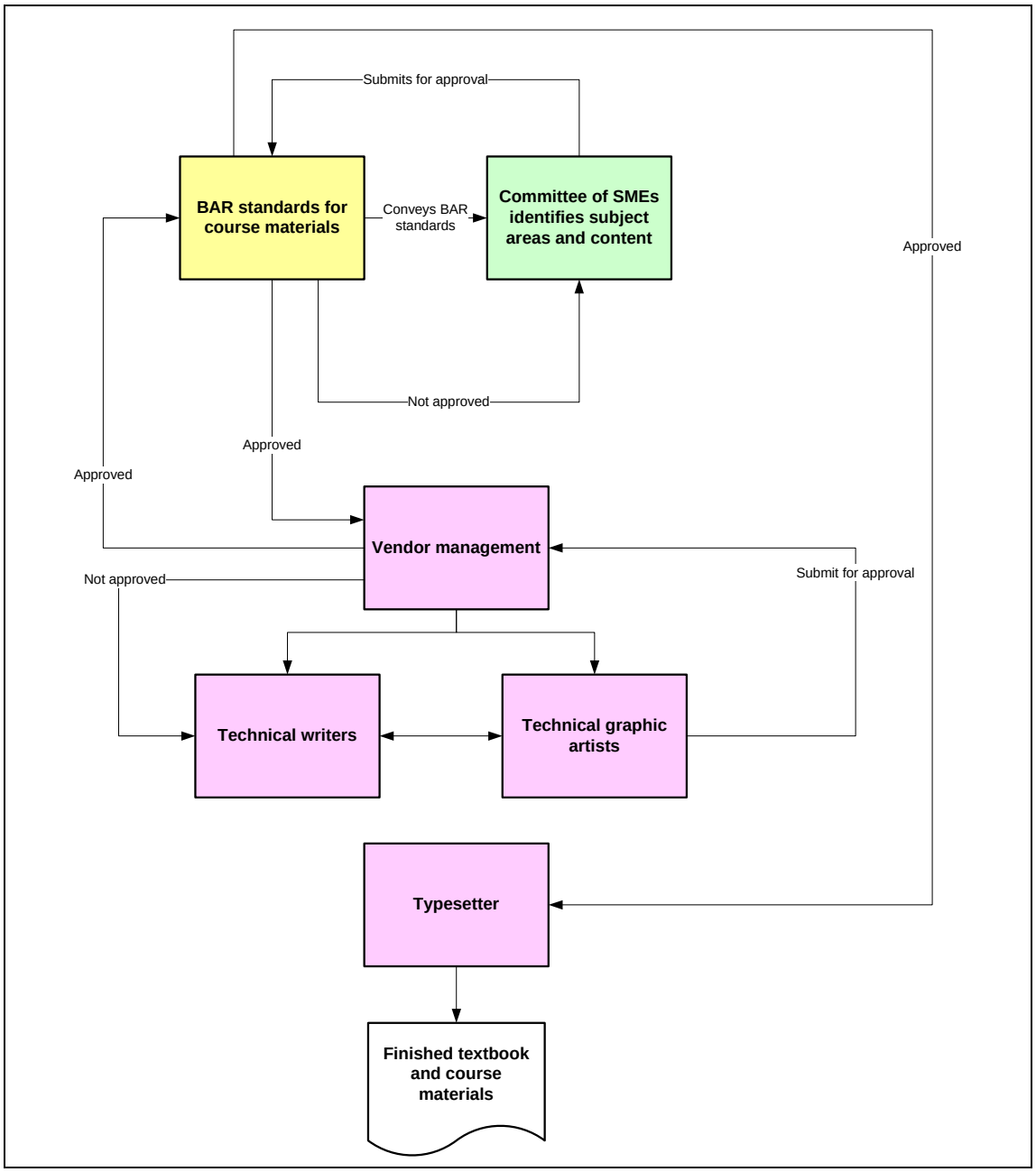



PROPOSED MODEL FOR COURSE MATERIALS

Figure 5 illustrates the process by which textbook development and selection would proceed. Here, BAR sets the standards for all course materials. BAR works with a

committee of SMEs (paid by the state) to identify subject matter areas and content for the course materials. BAR selects a single vendor, knowledgeable of the field and of professional standards for publication, to develop textbooks and other course material. The vendor's management works closely with its technical writers and technical graphic artists to develop the content and graphics for the textbooks and other course material. The final draft of the material is submitted to BAR and subject matter experts, e.g., committee of instructors, for approval. Once the material is approved by BAR, the printer produces the final textbooks and other course material.

Figure 5 – Proposed model for selection of textbooks and course materials



# SECTION 9: LIMITATIONS OF FINDINGS

Because Survey #1 included the majority of BAR certified instructors, there were no limitations on the results.

With respect to Surveys #2, #3 and #4, only licensed technicians completed the survey. The target samples did not include technicians who failed the Smog Check examination. Statistics indicate that nearly 37% of the candidates who take the examination fail on their first attempt. The fact that only licensed technicians participated in the surveys may account for the finding that technicians and technician-station owners reported that their knowledge of key subject matter areas was strong and they were satisfied with the training they received in the Smog Check training program. It is reasonable to assume that those who failed completed the training program with the intent of getting a license; however, the training program did not adequately prepare them for the Smog Check examination. Consequently, had the failing candidates been included in the survey, there may have been less satisfaction with the training program.

In Survey #3, approximately 9% of the technician-owners/supervisors employed three or more technicians. The remaining 50% were the sole technicians at the stations, and 40% employed an additional 1 to 2 technicians. As a result, the ratings may not be a true reflection of a supervisor assessing the strengths and weakness of other technicians. Rather, the ratings may be influenced by technicians in one-person shops were characterizing the strengths or weaknesses of their own competencies.

# SECTION 10: SUMMARY AND CONCLUSIONS

RECOMMENDATIONS – REQUIRING LEGISLATIVE ACTION

The following recommendations will require changes in regulations:

RECOMMENDATION A3. Create a two-tiered system for applicants seeking initial licensure. This would involve creating a new licensure program for persons who performed inspections only.

Two license types would be created: a license for conducting Smog Check inspections, and a license for performing diagnosis and repairs. The Emissions Inspection Technician license would require minimal training in engine performance and would focus on the laws and requirements of the Smog Check Program as well as the skills required to perform Smog Check inspections. The Emissions Diagnostic and Repair Specialist license, which requires an Emissions Inspection Technician license as a prerequisite, would require training in electrical/electronics, and advanced engine performance and driveability, or their educational or certification equivalent.

RECOMMENDATION A5. Stop licensing new EB technicians after December 31, 2009 and require existing EB technicians to successfully complete additional coursework (ASM inspections, NOx diagnostics prior to accepting positions in Enhanced Areas, as appropriate.

RECOMMENDATION B4. Refine standards and procedures for certifying instructors. Technical qualifications should be based on pre-established standards that describe the appropriate level of technical expertise and subject area proficiency.

Prospective instructors, who seek BAR certification, should be required to complete an instructional basics training course and demonstrate that they possess the necessary competencies to deliver training effectively.

Prospective instructors would be required to fulfill technical qualifications to ensure that their experience

includes theoretical as well as in-depth practical knowledge of the material (e.g., provide documentation supporting prior education and experience, student evaluations of instructor effectiveness, student evaluations of course content, samples of course examinations, and proof of teaching ability prior to becoming certified by BAR).

RECOMMENDATION B5. Develop new procedures to certify and/or audit training institutions and instructors. The procedures should include standardized measures to assess quality of instruction and student outcomes. Underachieving institutions and/or instructors should be subject to remedial or disciplinary measures, including revocation of BAR certification.

RECOMMENDATION B6. Develop criteria for identifying underachieving instructors. Each training institution would be responsible for annual or biennial evaluations of certified instructors such that underachieving instructors would be required to take remedial coursework and document improvements that will be implemented in course instruction.

Underachieving instructors would be subject to disciplinary measures, e.g., remedial coursework, documentation of instructor competence, revocation of certification. Initial examinees should be surveyed regarding the quality of instruction obtained from both schools and instructors for all BAR training courses prior to licensure. Renewal licensees should be surveyed during the application process. Surveys to be conducted electronically through BAR's examination contractor and/or online using BAR's website.

## RECOMMENDATIONS – REQUIRING PROGRAMMATIC CHANGES

The following regulations will require programmatic changes in the Smog Check training program:

RECOMMENDATION A1. Re-engineer BAR's Training Program to better accommodate inexperienced technicians by establishing a sequentially progressive training track.

Identify experienced/highly-trained technicians by developing a process for assessing knowledge, skills and abilities prior to training and only mandate training necessary relative to the candidate's knowledge, skills and abilities. BAR should

accept existing nationally recognized automotive training, certification and degree standards such as National Institute for Automotive Service Excellence (ASE) certifications, National Automotive Technician Education Foundation (NATEF) accredited training programs, and recognized degree programs.

RECOMMENDATION A2. Conduct an occupational (job) analysis to identify the tasks performed and the knowledge base for technicians who perform inspections. The premise for an examination should be based on the results of an occupational analysis to identify the tasks performed and the knowledge skills, and abilities necessary to perform effectively.

The results of the occupational analysis will serve as the foundation for an examination that measures competencies required to conduct inspections but not perform emissions-related repairs.

RECOMMENDATION A4. Create a transition period of one or two years prior to biennial renewal, in which persons who do not possess the ASE driveability certification, for example, would be required to obtain certification if they seek to obtain an Emissions Diagnostic and Repair Specialist license.

RECOMMENDATION B1. Restructure content of courses into modules to allow flexibility in content and course offerings. BAR, working with others, should create a modular format so that older technologies and newer technologies can be presented in perspective, and older technologies or less important topics can be removed and replaced, as appropriate. The modular format should be designed to provide flexibility for schools in processing curriculum changes and adding new program requirements.

RECOMMENDATION B2. Courses should include more exercises involving diagnostic situations that utilize scan tool data and wiring schematics. The diagnostic situations should be designed to teach students to analyze vehicle systems using commonly encountered data.

RECOMMENDATION B3. Incorporate more hands-on exercises in the diagnosis and repair course that involve commonly encountered inspection and diagnostic situations. The exercises should emphasize development of diagnostic skills, use of data and scan tools, and following manufacturer's or other industry-accepted procedures in the process.

RECOMMENDATION B7. Develop a "pass-fail" hands-on ("end-of-course") examination to be administered as part of the final examination at the school. The examination should assess the candidate's competencies to perform emissions-related inspections, diagnosis, and repairs. Develop procedures for administering and scoring the hands-on examination and keeping the examination current and secure.

RECOMMENDATION B8. Develop selection procedures to verify the required amount of experience prior to admitting the students into the Smog Check technician program.

RECOMMENDATION B9. Additional modules devoted to emission related repairs should be added to the training curriculum to better prepare technicians to perform emission-related repairs. The training modules would facilitate different inspection types (OBD II only, diesel, BAR 2010/tailpipe) and the distinction between technicians who perform inspections and technicians who perform diagnosis and repairs. A hands-on examination of student skills should be given prior to completion of inspection technician and diagnosis and repair technician coursework.

RECOMMENDATION C1. Under BAR's guidance and direction, contract with a single vendor to provide a course curriculum and materials for new vehicle technologies. The publisher should have technical expertise in emissions testing and automotive repair.

The vendor could be a community college automotive engineering department, the Foundation for California Community Colleges, or a private firms such as ASPIRE (Automotive Support Programs for Inspection, Repair and Emissions).

RECOMMENDATION C2. Contract with an automotive expert and/or utilize knowledgeable BAR instructors to serve as the primary instructors of the biennial instructor update course.

RECOMMENDATION D1. Require each subject matter expert or vendor to sign a nondisclosure and/or examination security agreement prior to participation in any BAR-sponsored program activity.

RECOMMENDATION D2. Establish steps to be taken if subject matter experts or vendors violate the terms of the nondisclosure and/or examination security agreement.

RECOMMENDATION D3. Verify that subject matter experts possess valid licenses and have a signed nondisclosure and/or examination security agreement within the past two years prior to participation in BAR-sponsored activities.

RECOMMENDATION D4. Create a database to track subject matter experts, including the names, addresses, and telephone numbers of all experts who sign the nondisclosure and/or examination security agreement.

RECOMMENDATION D5. Contract with a single vendor to design a hands-on "end-of-course" examination that meets BAR's specifications. The vendor should have technical expertise in emissions-related inspections, diagnosis and repairs as they relate to California rules and regulations.

The vendor should be required to have technical expertise in emissions testing and automotive repair. The vendor could be a community college automotive engineering department, the Foundation for California Community Colleges, or a private firm such as ASPIRE.

RECOMMENDATION D6. Under BAR's guidance and direction, contract with a single vendor to guide committees of content experts in developing curriculum, curriculum standards, selection procedures for instructors, and outcome measures for students and training institutions. The vendor should be required to have technical expertise in emissions testing and automotive repair.

## CONCLUSIONS

A successful training program must focus on job-related activities if technicians are expected to competently perform emission-related inspections, diagnosis and repair. Therefore, inspection and diagnosis/repair technicians must learn theory as well as apply that theory to commonly encountered diagnostic situations that occur on the job.

To accomplish these ends, BAR should play a significant role in developing curriculum standards, instructor standards, student admission standards, instructor competency standards, and auditing quality of training institution facilities rather than developing and reviewing course materials.

BAR should contract with a vendor, knowledgeable in emissions-related inspection, diagnosis and repair, to design course materials and oversee curriculum standards. BAR should also utilize a vendor to facilitate committees of instructors and subject matter experts to select topics to be included in coursework and develop curriculum standards and course specifications.

BAR would continue to take the lead in designing testing procedures, certifying equipment and software, and updating Smog Check Program laws, regulations and requirements for licensed technicians.

Accountability for assessing instructor competency should be conducted periodically to ensure adherence to instructor competency standards developed by BAR. Selection criteria for admission into BAR Smog Check training programs should be developed by BAR and rigorously administered by the training institutions.

## AREAS FOR ADDITIONAL STUDY

### HANDS-ON EVALUATIONS

The content covered in hands-on training exercises and a hands-on "end-of-course" examination should take top priority for additional study. There are several important psychometric and practical issues that should be explored prior to developing defensible performance evaluations.

Structure and conceptual framework. Suitable content should be identified for the hands-on exercises. The best source of content comes from an occupational (job) analysis. The general rule of thumb is to identify content that requires candidates to apply knowledge and training within a systematic and time-limited framework. Content that can be assessed in other formats, such as multiple-choice examinations should be excluded. Once suitable content is identified, operational definitions of the constructs (concepts) to be assessed should be developed.

Standardized format. The tasks to be performed should be standardized and linked to the content identified in an occupational analysis.

Stimulus materials. The stimulus materials to be used should be the same for all candidates. By adopting a standardized approach, the only difference between the candidates is their application of their training and education. The stimulus materials should be equivalent for all candidates in terms of the types, amount of detail and complexity.

Scoring criteria and passing standards. Scoring criteria should be linked to the content identified in an occupational analysis so that examiners have an objective means to judge the quality of technician responses.

Scoring rubric. Scoring rubrics are crucial to the derivation of a fair and meaningful score for each candidate. The fairest approach is to sum the points from all subject matter areas in the hands-on evaluation.

Administrative protocols. Standardized administrative protocols for administering the examination should be developed to enhance reliability, reduce construct irrelevance, and ensure that every candidate has the same assessment experience.

Examiner training. Formal training and retraining of examiners is the most essential element of a performance examination. A sound training program is conducted well in advance of the performance examination and allows multiple opportunities for examiners to familiarize themselves with the scoring criteria and practical strategies for pacing the examination.

### CORE COMPETENCIES OF TECHNICIANS UPON COMPLETION OF TRAINING

Survey #2 indicated that technicians want more specific diagnostic and repair information to help repair failing vehicles. BAR should consider providing real-time diagnosis and repair information to technicians to assist them in diagnosing the cause of vehicle failures in a cost-effective and efficient manner.

### OBD II ONLY TESTING

The California Inspection and Maintenance Review Committee (IMRC), the U. S. Environmental Protection Agency (USEPA) and California Air Resources Board (ARB) are recommending inspection and maintenance (I/M) programs (including the California Smog Check Program) to consider the use of OBD II testing and the elimination of the tailpipe test for many or most 1996 and newer OBD II equipped vehicles. While OBD only may be less effective than an OBD plus tailpipe program, it is estimated that the simpler test would cost less than the current test. The equipment and technician skills required to perform an OBD only test are less than those to perform a tailpipe test. In the event that BAR adopts OBD only testing, such a change would raise new questions regarding the testing and training requirements for technicians.

### NEW MANDATED REQUIREMENTS FOR VEHICLE INSPECTION

The Smog Check program is adding new mandated requirements to inspect diesel vehicles and anticipates the addition of other vehicles requiring inspection, e.g., motorcycles, hybrid vehicles, etc. BAR needs to be proactive in establishing processes and procedures to accommodate training for emissions-related inspection and repair of these vehicles.

# SECTION 10: REFERENCES


2009 BAR update training "draft" development plan (2008). Sacramento, CA: Bureau of Automotive Repair.

April 2004 evaluation of the California enhanced vehicle inspection and maintenance (Smog Check) program: Report to the Legislature (September 2005). Submitted by Air Resources Board and Department of Consumer Affairs/Bureau of Automotive Repair

Automotive program guide (certification process). (2008). Retrieved from http://www.natef.org/tips.cfm, May 16, 2008.

Course enrollment and licensing exam trends CY 2004 – 2007. (2008). Sacramento, CA: Bureau of Automotive Repair.

Cronbach, L. J. and Meehl, P. E. (1955). Construct validity in psychological tests. Psychological Bulletin, 51, 281-302.

Executive summary – February 2008 Smog Check data. (2008). Sacramento, CA: Bureau of Automotive Repair.

Letter to Bill Kersten, President, National Automotive Technicians Education Foundation. Written by the Bureau of Automotive Repair (March 12, 2007).

McCormick, E. J. (1976). Job and task analysis. In M.D. Dunnette (Ed.), Handbook of Industrial and Organizational Psychology, 651-696.

McCormick, E. J. (1979). Job Analysis. New York: American Management Association.

Memorandum to Sherry Mehl, BAR Chief, regarding a new strategy for Smog Check technician training. Written by Bureau of Automotive Repair's Technical Service Branch (February 15, 2007).

Memorandum to Sherry Mehl, BAR Chief, regarding examination scores for the EA and EB Smog Technician written examinations (April 8, 2008).

Review of the Smog Check program. (November 27, 2007). California Inspection and Maintenance Review Committee (IMRC).

School performance state exam analysis. (2008). Sacramento, CA: Bureau of Automotive Repair

School success rate for Smog Check licensing exam. (2008). Sacramento, CA: Bureau of Automotive Repair

Smog check program evaluation project. (2006). Presented to the California IMRC. Retrieved from http://www.imreview.ca.gov/archives/archived_presentation/p_heirigssierra_res_1024.06.pdf.

Standards for Educational and Psychological Testing (prepared by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education. (1999). Washington, DC: American Educational Research Association.

Transitioning I/M workgroup of the Mobile Source Technical Review Subcommittee. Options for inspection and maintenance in the OBD dominated fleet (2008). Washington, DC: US Environmental Protection Agency.

Vendor specifications for Bureau training program. (1995). Sacramento, CA: Bureau of Automotive Repair.

# APPENDIX A: INSTRUCTOR RESPONSES

NOTE: Fifty-five of the 118 instructors were not included in the analysis because they taught only 1 to 3 courses or had not taught over the past two years. Therefore, only the results of 63 instructors are presented.

**1. During 2007, approximately how many BAR certified courses have you taught?**

For example, if you taught 1 ASE alternative course, 3 Basic Clean Air Car Courses, 4 BAR update training courses, and 1 Citation Level I course, you would check the box for "8 to 12 courses in total.

| | Frequency | Percent |
|---|---|---|
| 4 to 7 courses in total | 14 | 22.2 |
| 8 to 12 courses in total | 29 | 46.0 |
| 13 or more courses in total | 20 | 31.7 |
| Total | 63 | 100.0 |

**2. Approximately how many years have you been a BAR certified instructor?**

| | Frequency | Percent |
|---|---|---|
| 2 years or fewer | 4 | 6.3 |
| 3 to 5 years | 15 | 23.8 |
| 6 to 10 years | 18 | 28.6 |
| More than 10 years | 26 | 41.3 |
| Total | 63 | 100.0 |

**3. Which of the following BAR certified courses have you taught within the last four (4) years? (Check all that apply)**

| | |
|---|---|
| BAR update training course (2007 and/or 2005) | 61 |
| Advanced Clean Air Car Course (ACACC) | 53 |
| Basic Clean Air Car Course (BCACC) | 50 |
| Automotive Electrical/Electronic systems (A6) | 43 |
| Automotive Advanced Engine Performance Specialist (L1) | 42 |
| Automotive Engine Performance (A8) | 43 |
| Citation Level I, and/or II | 32 |
| I have not taught BAR certified courses in the last four (4) years | 1 |

4. **During 2007, in which of the following educational institutions have you taught BAR certified training courses?** (Check all that apply)

| | |
|---|---|
| Community college | 37 |
| Private vocational school | 25 |
| Other | 6 |
| Occupational center | 5 |
| Regional Opportunity Program (ROP) | 4 |

Other included: Fleet training, None, skill center

5. **How many hours of supplemental training have you received in the engine performance/emission diagnostic area in the past 2 years?**

   **This does not include any training needed to maintain your Smog Check technician license or instructor certification)**

| | Frequency | Percent |
|---|---|---|
| 0 to 5 hours | 6 | 9.5 |
| 5 to 10 hours | 4 | 6.3 |
| 10 to 20 hours | 11 | 17.5 |
| 20 to 50 hours | 27 | 42.9 |
| More than 50 hours | 15 | 23.8 |
| Total | 63 | 100.0 |

6. **Since 2004, BAR statistics reveal that more than 50% of all Smog Check candidates fail their state licensing exam.**

   **Do you believe the current BAR certified course curriculum is adequate to prepare students to successfully pass the state exam and perform Smog Check inspections and emission-related repairs?**

   **Check the statement that best reflects your views.**

| | Frequency | Percent |
|---|---|---|
| Curriculum is adequate | 2 | 3.2 |
| Curriculum could be improved with a few minor adjustments | 6 | 9.5 |
| Curriculum is adequate, but needs to be updated | 14 | 22.2 |
| Curriculum is adequate but course hours need to be expanded | 3 | 4.8 |
| Both curriculum and course hours need to be overhauled | 33 | 52.4 |
| Other comments | 5 | 7.9 |
| Total | 63 | 100.0 |

**7. From your perspective, for students who are acquiring their Smog Check license what are the most important subject areas they need in-depth training on?**

***(Check a maximum of FIVE [5] top subject areas)***

| | |
|---|---|
| Theory and operations of Emission Control Systems (ECS) | 34 |
| Basic electrical (ignition) and electronic systems theory | 33 |
| Advanced electrical/electronic system operations | 30 |
| Advanced engine performance | 29 |
| Diagnosis and repair of emission-related electrical/electronic systems | 28 |
| Smog Check Program Rules and Regulations | 26 |
| Basic diagnostic processes and procedures | 25 |
| Diagnosis and repair of emission-related engine performance systems | 25 |
| Reading and interpreting system diagrams and schematics | 22 |
| Advanced fuel trim/delivery system diagnostics | 21 |
| Basic engine theory and testing procedures | 20 |
| General engine performance | 19 |
| On-Board Diagnostic (OBD) II fuel evaporative systems theory, operation and testing | 18 |
| Scan tool usage | 18 |
| Adaptive fuel trim strategies | 15 |
| Advanced diagnostic and repair procedures for CAN | 15 |
| Application of Mode 6 information for emission failure diagnostics | 13 |
| CAN operating systems | 13 |
| Proper use of diagnostic repair manuals | 13 |
| Electronic Throttle Control theory and operation | 12 |
| Emission control system (ECS) identification procedures | 12 |
| Theory and operations of fuel systems | 11 |
| Access procedures and use of Technical Service Bulletins | 9 |
| How to use the BAR-97 EIS and dynamometer | 9 |
| Using Lambda calculations to diagnose emission failures | 8 |
| Variable valve timing | 8 |
| Computer Re-flashing | 7 |
| Acceleration Simulation Mode (ASM) testing | 6 |
| Two-speed idle (TSI) testing | 4 |

**8. Check the top THREE (3) issues from those listed below that you believe pose the biggest obstacles to an instructor when teaching BAR certified training courses?**

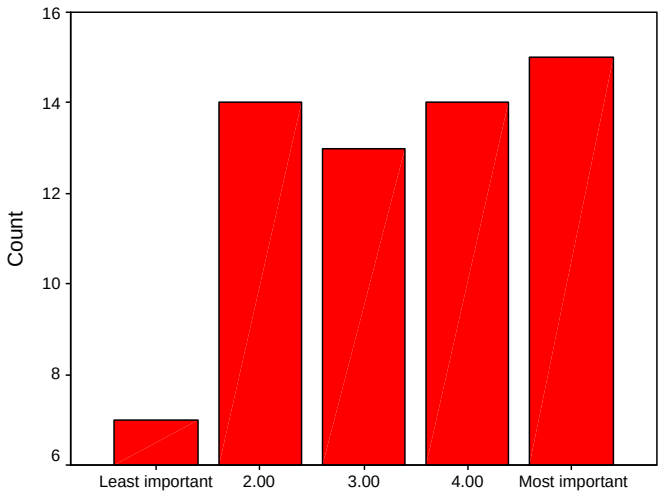
| | |
|---|---|
| Beginning students today have less automotive experience and knowledge | 40 |
| Curriculum and course content need to be updated and improved | 38 |
| Students for whom English is a second language present increased challenges | 25 |
| Fewer students today are interested in a career as an automotive technician | 17 |
| Too much content for the number of course hours | 15 |
| Sufficient time is not available for adequate “hands-on” training | 14 |
| BAR provides inadequate support for developing and updating course materials | 13 |
| BAR commits inadequate resources to address the challenges instructors face in the classroom | 13 |
| The high cost related to purchasing and maintaining BAR-required equipment and tools | 9 |
| The school lacks sufficient resources to provide an adequate “hands-on” training experience | 7 |

**9. Rank, in order of importance, actions that BAR should take to improve the effectiveness of the Basic and Advanced**

**Check the boxes that correspond to your rankings for the following five actions. (1= least important, 5 = most important) Only one check should be placed in each column. There should be only one rank of 5, one rank of 4, one rank of 3, one rank of 2, and one rank of 1.**

**9(a) Update course text materials, handouts, and assignments**

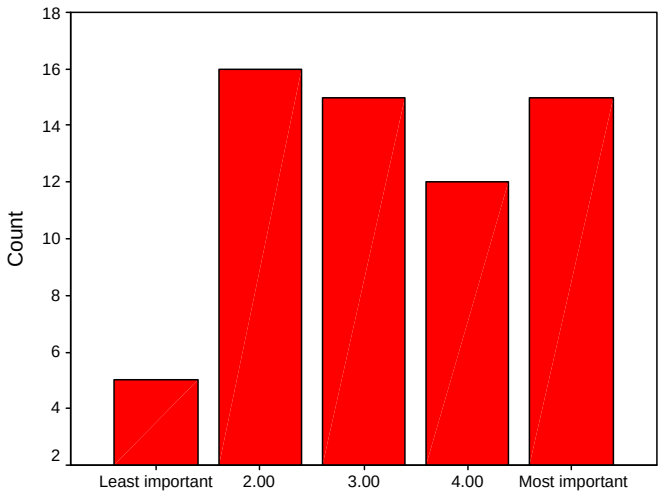
| | Frequency | Percent |
|---|---|---|
| Least important | 7 | 11.1 |
| 2.00 | 14 | 22.2 |
| 3.00 | 13 | 20.6 |
| 4.00 | 14 | 22.2 |
| Most important | 15 | 23.8 |
| Total | 63 | 100.0 |




Q9A Update course text materials handouts assignments

## 9(b) Revise the curriculum to better integrate new program requirements and key elements from prior update training courses

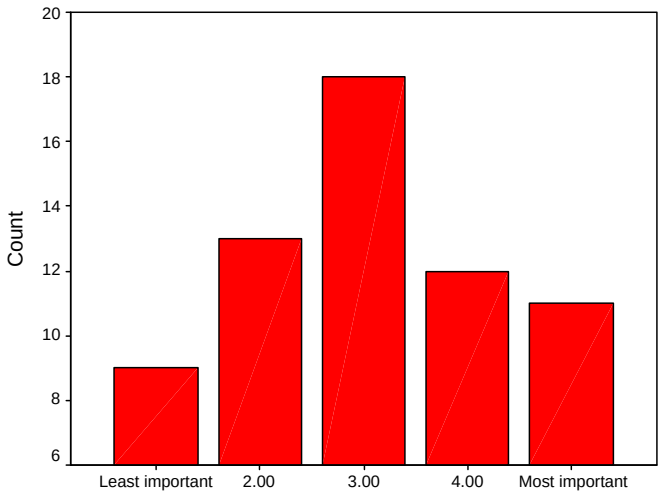
| | Frequency | Percent |
|---|---|---|
| Least important | 5 | 7.9 |
| 2.00 | 16 | 25.4 |
| 3.00 | 15 | 23.8 |
| 4.00 | 12 | 19.0 |
| Most important | 15 | 23.8 |
| Total | 63 | 100.0 |




Q9B Revise curr to better integrate new prg req/elements

## 9(c) Increase “hands-on” laboratory training

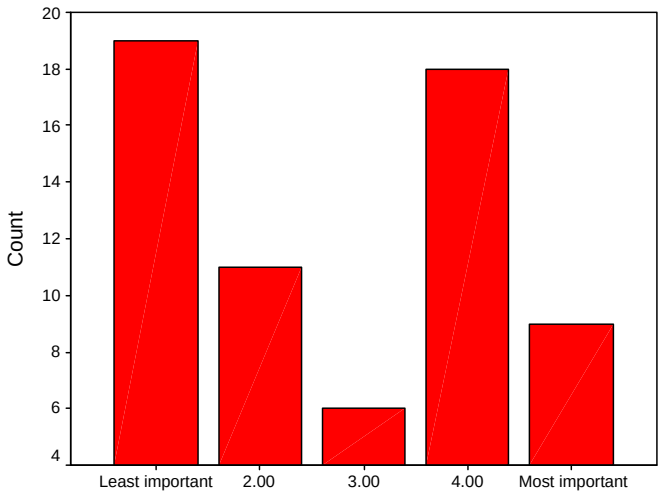
| | Frequency | Percent |
|---|---|---|
| Least important | 9 | 14.3 |
| 2.00 | 13 | 20.6 |
| 3.00 | 18 | 28.6 |
| 4.00 | 12 | 19.0 |
| Most important | 11 | 17.5 |
| Total | 63 | 100.0 |




Q9C Increase hands on lab training

## 9(d) Provide multimedia (computer-based training, videos, and/or Internet) learning materials

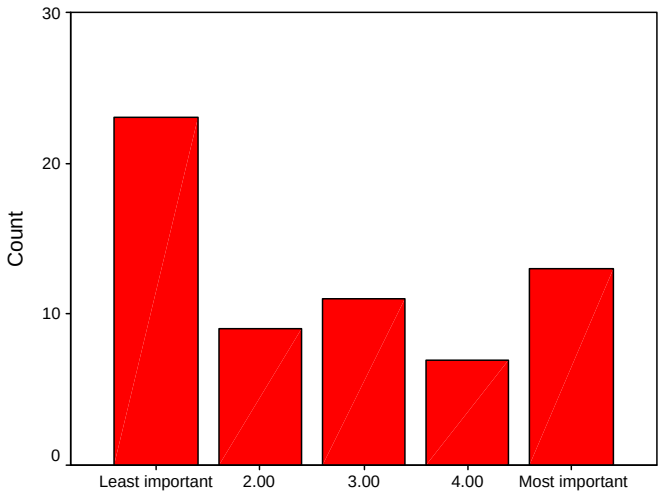
| | Frequency | Percent |
|---|---|---|
| Least important | 19 | 30.2 |
| 2.00 | 11 | 17.5 |
| 3.00 | 6 | 9.5 |
| 4.00 | 18 | 28.6 |
| Most important | 9 | 14.3 |
| Total | 63 | 100.0 |




Q9D Action_Provide multi media learning materials

## 9(e) Expand the course hours to allow for adequate coverage of course content

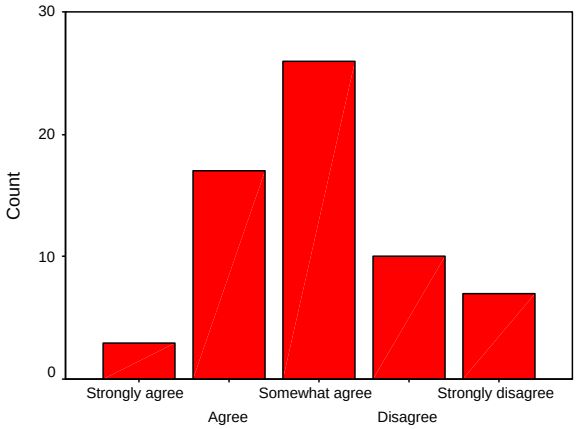
| | Frequency | Percent |
|---|---|---|
| Least important | 23 | 36.5 |
| 2.00 | 9 | 14.3 |
| 3.00 | 11 | 17.5 |
| 4.00 | 7 | 11.1 |
| Most important | 13 | 20.6 |
| Total | 63 | 100.0 |




Q9E Expand course hours to allow for adeq coverage

**10. From an instructor's perspective, do you agree that the combined training that includes the BAR ASE Alternative, Basic and Advanced Clean Air Car Course, and BAR update training courses adequately prepares students on the theory and operation of emission control systems?**

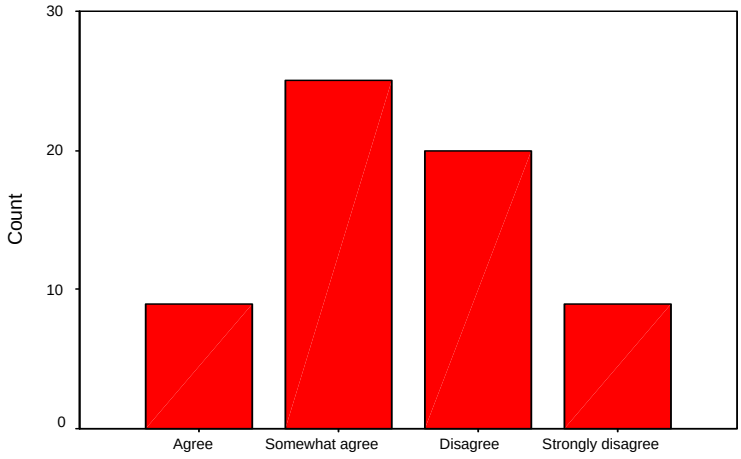
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 3 | 4.8 |
| Agree | 17 | 27.0 |
| Somewhat agree | 26 | 41.3 |
| Disagree | 10 | 15.9 |
| Strongly disagree | 7 | 11.1 |
| Total | 63 | 100.0 |




Q10 Combined training prepares students on th/op of ECS

**11. From an instructor's perspective, do you agree that the combined training that includes the BAR ASE Alternative, Basic and Advanced Clean Air Car Course, and the BAR update training courses adequately prepares a student to diagnose and repair vehicle emission failures?**

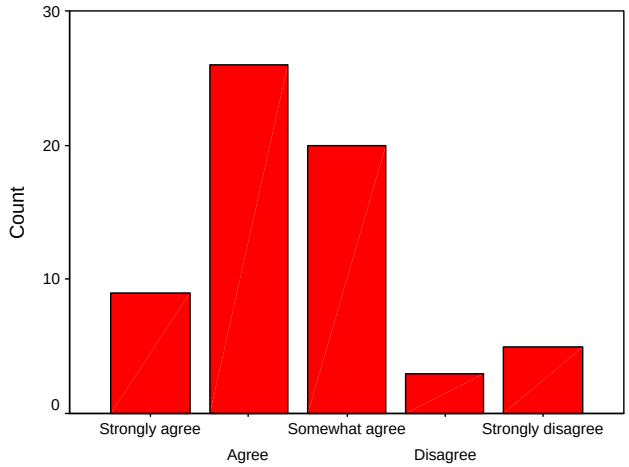
| | Frequency | Percent |
|---|---|---|
| Agree | 9 | 14.3 |
| Somewhat agree | 25 | 39.7 |
| Disagree | 20 | 31.7 |
| Strongly disagree | 9 | 14.3 |
| Total | 63 | 100.0 |




Q11 Combined training prepares students to diagnose and repair

**12. From an instructor's perspective, do you agree that the combined training that includes the BAR ASE Alternative, Basic and Advanced Clean Air Car Course, and the BAR update training courses adequately prepares a student to properly perform a Smog Check inspection?**

| | Frequency | Percent |
|---|---|---|
| Strongly agree | 9 | 14.3 |
| Agree | 26 | 41.3 |
| Somewhat agree | 20 | 31.7 |
| Disagree | 3 | 4.8 |
| Strongly disagree | 5 | 7.9 |
| Total | 63 | 100.0 |



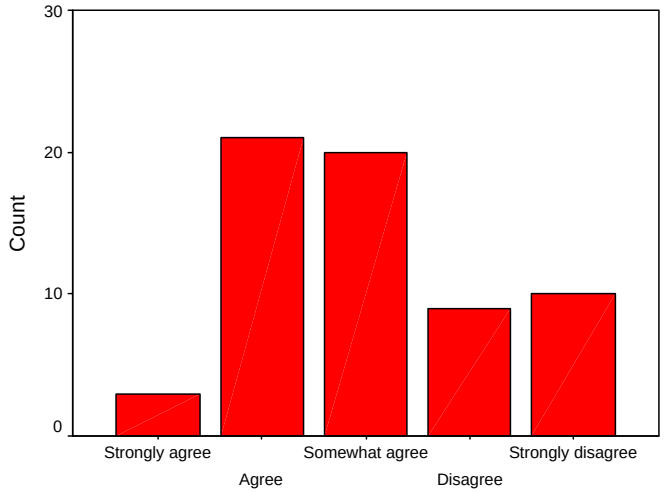

Q12 Combined trng prepares students to perform Smog Ck

**13. For each BAR certified course listed below, select the level of agreement that most closely reflects your opinion about the following statement:**

**"The BAR-approved books and other printed material used for each course listed below are adequate for accomplishing the training objectives. Check the box that corresponds to your rating for each course."**

**13(a) Automotive Electrical/Electronic systems (A6)**

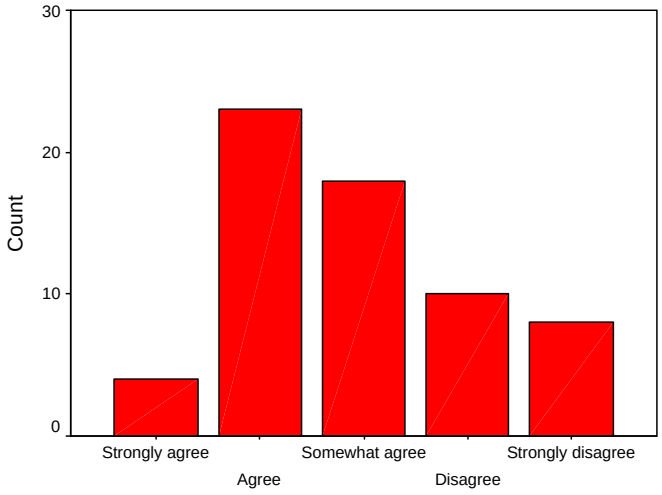
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 3 | 4.8 |
| Agree | 21 | 33.3 |
| Somewhat agree | 20 | 31.7 |
| Disagree | 9 | 14.3 |
| Strongly disagree | 10 | 15.9 |
| Total | 63 | 100.0 |




Q13A A6 books and other material are adequate

## 13(b) Automotive Engine Performance (A8)

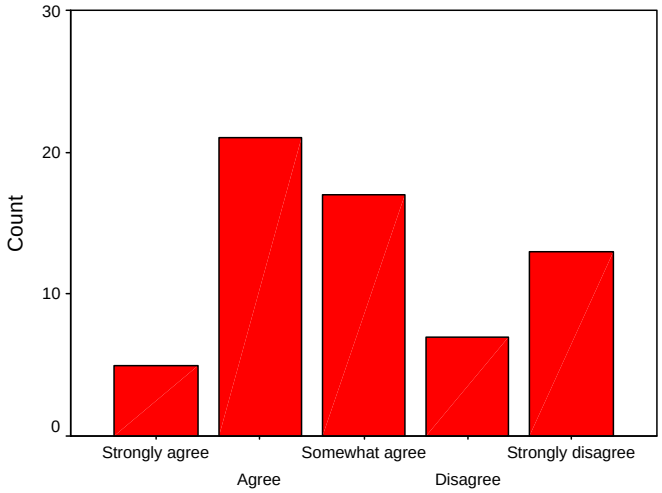
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 4 | 6.3 |
| Agree | 23 | 36.5 |
| Somewhat agree | 18 | 28.6 |
| Disagree | 10 | 15.9 |
| Strongly disagree | 8 | 12.7 |
| Total | 63 | 100.0 |




Q13B A8 books and other material are adequate

## 13(c) Automotive Advanced Engine Performance Specialist (L1)

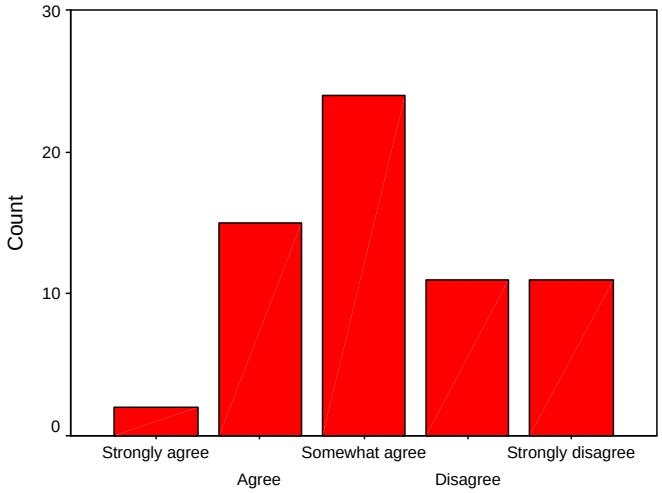
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 5 | 7.9 |
| Agree | 21 | 33.3 |
| Somewhat agree | 17 | 27.0 |
| Disagree | 7 | 11.1 |
| Strongly disagree | 13 | 20.6 |
| Total | 63 | 100.0 |




Q13C L1 books and other material are adequate

## 13(d) Basic Clean Air Car Course (Basic CACC)

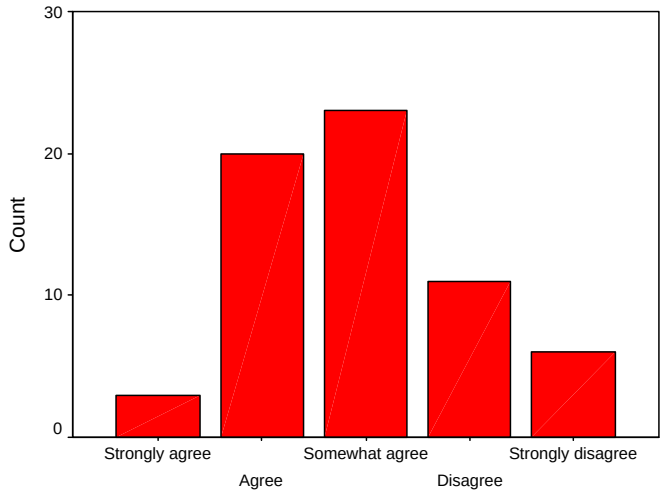
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 2 | 3.2 |
| Agree | 15 | 23.8 |
| Somewhat agree | 24 | 38.1 |
| Disagree | 11 | 17.5 |
| Strongly disagree | 11 | 17.5 |
| Total | 63 | 100.0 |




Q13D Basic CACC Books and other material are adequate

## 13(e) Advanced Clean Air Car Course (Advanced CACC)

| | Frequency | Percent |
|---|---|---|
| Strongly agree | 3 | 4.8 |
| Agree | 20 | 31.7 |
| Somewhat agree | 23 | 36.5 |
| Disagree | 11 | 17.5 |
| Strongly disagree | 6 | 9.5 |
| Total | 63 | 100.0 |




Q13E Adv CACC books and other material are adequate

**14. On average, when you instruct the BAR certified training courses, what percentage of time do you engaged in "hands-on" (laboratory) training?**

| | Frequency | Percent |
|---|---|---|
| 0 to 10% | 2 | 3.2 |
| 11 to 20% | 15 | 23.8 |
| 21 to 30% | 21 | 33.3 |
| 31 to 40% | 10 | 15.9 |
| 41 to 50% | 6 | 9.5 |
| 51 to 60% | 7 | 11.1 |
| 61 to 70% | 2 | 3.2 |
| Total | 63 | 100.0 |

**15. From an instructor's perspective, based on the course content how many hours should the BAR have allocated for the BAR 2007 update training course?**

| | Frequency | Percent |
|---|---|---|
| 12 hours | 13 | 20.6 |
| 16 hours | 26 | 41.3 |
| 20 hours | 18 | 28.6 |
| More than 20 hours | 6 | 9.5 |
| Total | 63 | 100.0 |

**16. Who should identify the course subject areas for the BAR courses?**

| | Frequency | Percent |
|---|---|---|
| BAR only | 1 | 1.6 |
| Instructors only | 1 | 1.6 |
| Both BAR and a committee of educators | 24 | 38.1 |
| Committee of SMEs paid by the state | 27 | 42.9 |
| Educational contractor hired by the state | 1 | 1.6 |
| Other | 9 | 14.3 |
| Total | 63 | 100.0 |

**17. Who should specify the course curriculum for the BAR courses?**

| | Frequency | Percent |
|---|---|---|
| BAR only | 2 | 3.2 |
| Instructors only | 3 | 4.8 |
| Both BAR and a committee of educators | 33 | 52.4 |
| Committee of SMEs paid by the state | 17 | 27.0 |
| Educational contractor hired by the state | 1 | 1.6 |
| Other | 7 | 11.1 |
| Total | 63 | 100.0 |

**18. Who should select and approve textbooks and other resource material for the BAR courses?**

| | Frequency | Percent |
|---|---|---|
| BAR only | 3 | 4.8 |
| Instructors only | 5 | 7.9 |
| Both BAR and a committee of educators | 29 | 46.0 |
| Committee of SMEs paid by the state | 16 | 25.4 |
| Educational contractor hired by the state | 4 | 6.3 |
| Other | 6 | 9.5 |
| Total | 63 | 100.0 |

**19. Would you support a "hands-on" examination (either computer generated or live exam) for students, upon completion of their required BAR courses? Assume that passage of the exam would allow the student to sit for the State Smog Check Technician examination.**

| | Frequency | Percent |
|---|---|---|
| Yes | 48 | 76.2 |
| No | 15 | 23.8 |
| Total | 63 | 100.0 |

**20. Do you believe an additional training module devoted to emission-related repairs should be added?**

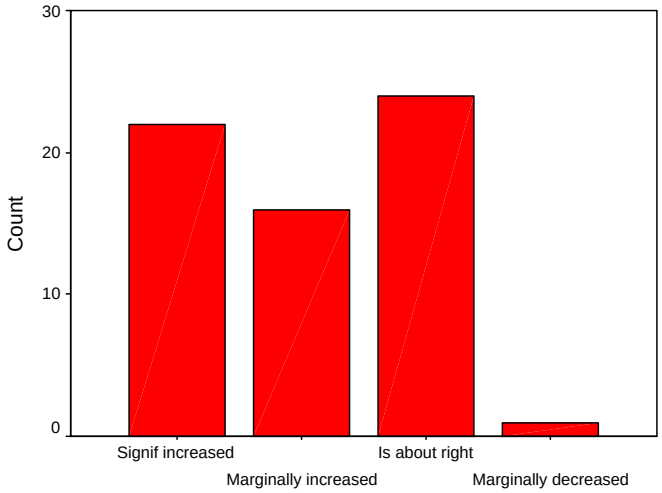
| | Frequency | Percent |
|---|---|---|
| Yes | 54 | 85.7 |
| No | 9 | 14.3 |
| Total | 63 | 100.0 |

**21. For which of the following courses would you support a "challenge" examination (either computer generated or live "hands-on" exam) *in lieu* of the student taking a complete the BAR course?**

| | Frequency | Percent |
|---|---|---|
| I would not support a challenge examination | 38 | 60.3 |
| Basic CACC | 4 | 6.3 |
| Advanced CACC | 1 | 1.6 |
| A6 alternative | 6 | 9.5 |
| A8 alternative | 3 | 4.8 |
| L1 alternative | 3 | 4.8 |
| Update training | 8 | 12.7 |
| Total | 63 | 100.0 |

**22. The amount of time spent on course basic topics should be _____.**

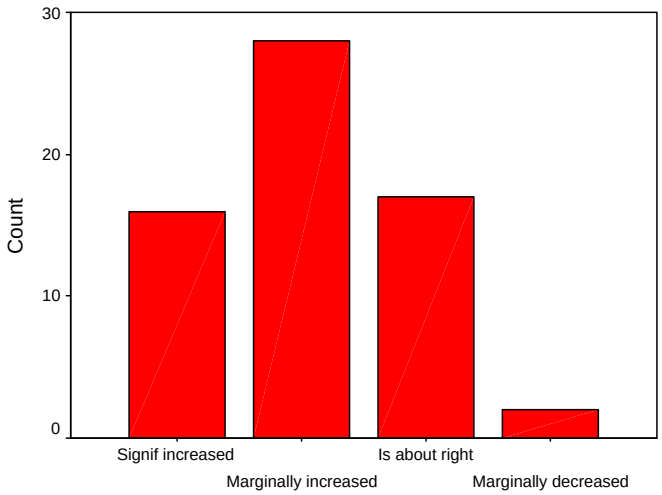
| | Frequency | Percent |
|---|---|---|
| Significantly increased | 22 | 34.9 |
| Marginally increased | 16 | 25.4 |
| Is about right | 24 | 38.1 |
| Marginally decreased | 1 | 1.6 |
| Total | 63 | 100.0 |




Q22 Time spent on basic topics should be _____

**23. The amount of time spent on advanced course topics areas should be _____.**

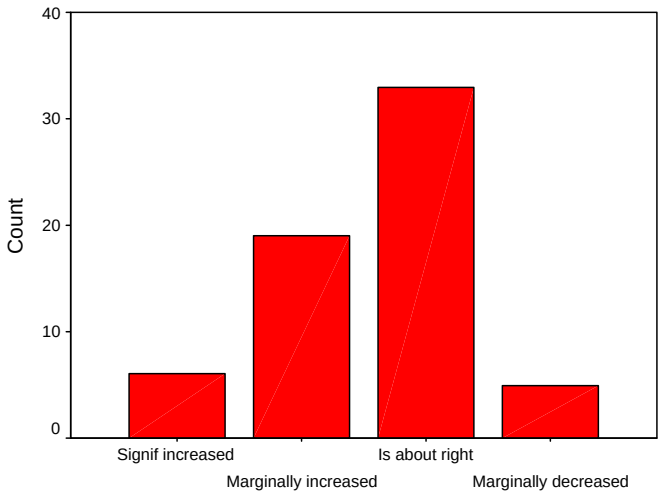
| | Frequency | Percent |
|---|---|---|
| Significantly increased | 16 | 25.4 |
| Marginally increased | 28 | 44.4 |
| Is about right | 17 | 27.0 |
| Marginally decreased | 2 | 3.2 |
| Total | 63 | 100.0 |




Q23 Time spent on adv topics should be _____

**24. The amount of time spent on review of California rules and regulations (Smog Check Program) should be _____.**

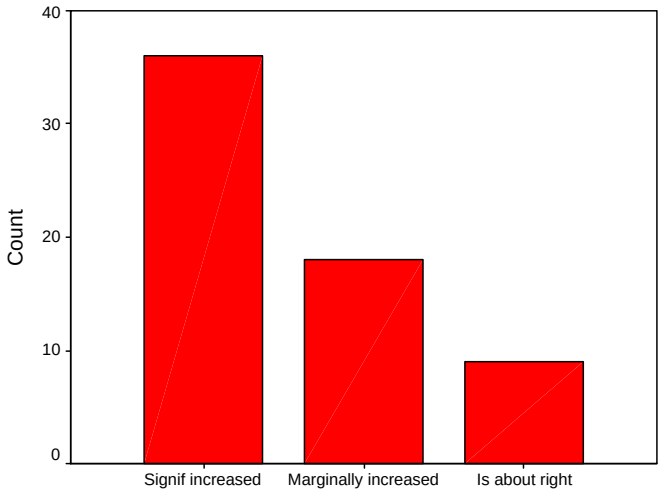
| | Frequency | Percent |
|---|---|---|
| Significantly increased | 6 | 9.5 |
| Marginally increased | 19 | 30.2 |
| Is about right | 33 | 52.4 |
| Marginally decreased | 5 | 7.9 |
| Total | 63 | 100.0 |




Q24 Time spent on Calif rules and regs should be _____

**25. The amount of time spent on emission-related diagnostic procedures should be _____.**

| | Frequency | Percent |
|---|---|---|
| Significantly increased | 36 | 57.1 |
| Marginally increased | 18 | 28.6 |
| Is about right | 9 | 14.3 |
| Total | 63 | 100.0 |




Q25 Time spent on emission related diag proc should be _____

**26. The instructor update course (every two years) should be provided by:**

| | Frequency | Percent |
|---|---|---|
| BAR staff | 11 | 17.5 |
| An automotive expert hired by the state | 20 | 31.7 |
| A knowledgeable BAR instructor | 22 | 34.9 |
| Other | 10 | 15.9 |
| Total | 63 | 100.0 |

# APPENDIX B: TECHNICIAN RESPONSES

**1. Where did you obtain your BAR training? (Check all that apply)**

| | |
|---|---|
| Private vocational school | 192 |
| Community college | 182 |
| Occupational center | 33 |
| Other | 32 |
| Regional Opportunity Program (ROP) | 4 |

**"**Other" included: We Teach U, Medacon College, on the job, trade school

**2. Based on your answer to Question # 1, check the rating that corresponds to your overall rating of each school you attended for BAR training. Note that technicians could check all schools that applied to them.**

| Poor | Fair | Average | Good | Excellent |
|---|---|---|---|---|
| 7 | 9 | 41 | 165 | 248 |

**3. Where are you currently employed?**

| | Frequency | Percent |
|---|---|---|
| Test-only station | 74 | 18.5 |
| Test and Repair incl Gold Shield | 218 | 54.5 |
| Fleet or referee facility | 11 | 2.8 |
| Emp but not at lic Smog Check | 37 | 9.3 |
| Not emp in auto repair | 59 | 14.8 |
| Total | 399 | 99.8 |
| Missing | 1 | .3 |
| Total | 400 | 100.0 |

**4. How many years have you been a licensed Smog Check Technician?**

| | Frequency | Percent |
|---|---|---|
| 1 to 6 months | 91 | 22.8 |
| 6 months to 1 year | 100 | 25.0 |
| 1 to 2 years | 164 | 41.0 |
| 2 or more years | 43 | 10.8 |
| Subtotal | 398 | 99.5 |
| Missing | 2 | .5 |
| Total | 400 | 100.0 |

**5. What National Institute of Automotive Service Excellence (ASE) certifications do you hold?**

| | |
|---|---|
| Automotive Engine Performance (A8) | 254 |
| Automotive Electrical/Electronic systems (A6) | 249 |
| Automotive Advanced Engine Performance Specialist (L1) | 197 |
| Other | 134 |
| None | 93 |

**6. How much automotive trade experience did you have <u>prior</u> to starting your first BAR course?**

| | Frequency | Percent |
|---|---|---|
| No auto trade exp | 46 | 11.5 |
| 1 to 6 mo | 24 | 6.0 |
| 6 mo to 1 year | 29 | 7.3 |
| 1 to 2 years | 60 | 15.0 |
| 2 to 5 years | 86 | 21.5 |
| More than 5 years | 154 | 38.5 |
| Subtotal | 399 | 99.8 |
| Missing | 1 | .3 |
| Total | 400 | 100.0 |

**7. How many automotive training courses did you complete <u>prior</u> to starting your first BAR course?**

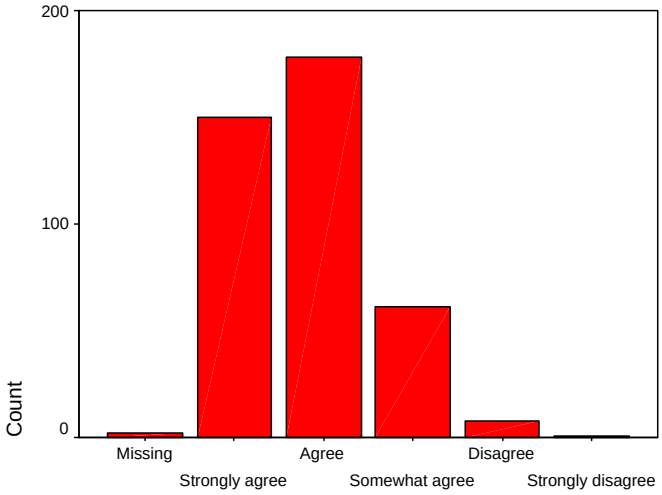
| | Frequency | Percent |
|---|---|---|
| Have not taken any auto courses | 84 | 21.0 |
| 1 to 2 courses | 51 | 12.8 |
| 2 to 3 courses | 37 | 9.3 |
| 3 to 4 courses | 24 | 6.0 |
| 4 to 5 courses | 28 | 7.0 |
| More than 5 courses | 173 | 43.3 |
| Subtotal | 397 | 99.3 |
| Missing | 3 | .8 |
| Total | 400 | 100.0 |

**8. Which of the following the BAR ASE Alternative courses have you completed? (Check all that apply)**

| | |
|---|---|
| Advanced Engine Performance | 302 |
| Electrical/Electronic systems | 258 |
| Automotive Engine Performance | 254 |
| None (did not complete any BAR ASE alternative) | 92 |

**9. Overall, the BAR training I received qualified me to perform emission-related repairs.**

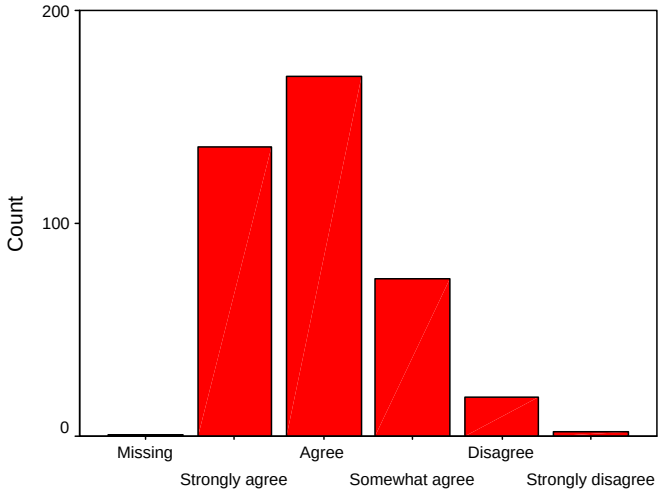
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 150 | 37.5 |
| Agree | 178 | 44.5 |
| Somewhat agree | 61 | 15.3 |
| Disagree | 8 | 2.0 |
| Strongly disagree | 1 | .3 |
| Subtotal | 398 | 99.5 |
| Missing | 2 | .5 |
| Total | 400 | 100.0 |




Q9_Overall BAR trng qualfied me to perf repairs

**10. The BAR training I received provided me adequate training to diagnose vehicle emission failures.**

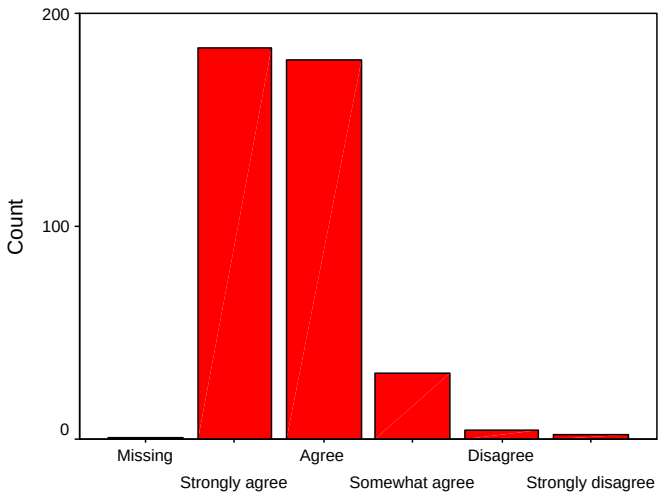
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 136 | 34.0 |
| Agree | 169 | 42.3 |
| Somewhat agree | 74 | 18.5 |
| Disagree | 18 | 4.5 |
| Strongly disagree | 2 | .5 |
| Subtotal | 399 | 99.8 |
| Missing | 1 | .3 |
| Total | 400 | 100.0 |




Q10_BAR trng provided adeq trng to diag emission failures

**11. The BAR training I received provided me adequate training on the theory and operation of emission control systems.**

| | Frequency | Percent |
|---|---|---|
| Strongly agree | 184 | 46.0 |
| Agree | 178 | 44.5 |
| Somewhat agree | 31 | 7.8 |
| Disagree | 4 | 1.0 |
| Strongly disagree | 2 | .5 |
| Subtotal | 399 | 99.8 |
| Missing | 1 | .3 |
| Total | 400 | 100.0 |



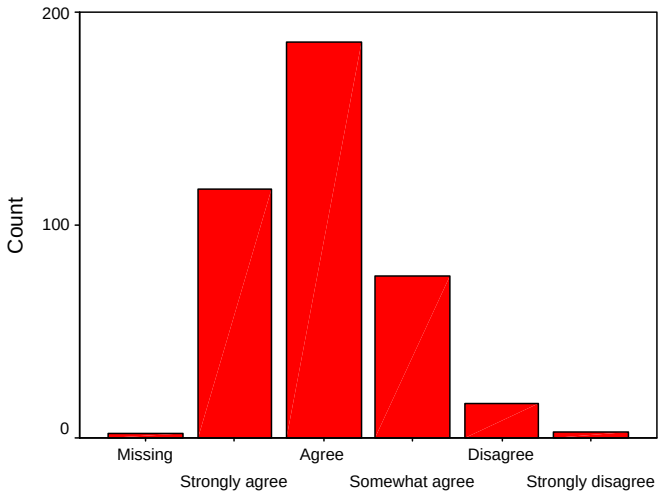

Q11_BAR trng provided adeq trng on th and op of ECS

**12. During your BAR training courses, what percentage of time were you engaged in hands-on (laboratory) training?**

| | Frequency | Percent |
|---|---|---|
| No lab | 1 | .3 |
| 0 to 10 pct | 25 | 6.3 |
| 11 to 20 pct | 47 | 11.8 |
| 21 to 30 pct | 50 | 12.5 |
| 31 to 40 pct | 75 | 18.8 |
| 41 to 50 pct | 70 | 17.5 |
| 51 to 60 pct | 47 | 11.8 |
| 61 to 70 pct | 25 | 6.3 |
| 71 to 80 pct | 20 | 5.0 |
| 81 to 90 pct | 21 | 5.3 |
| 91 to 100 pct | 17 | 4.3 |
| Subtotal | 398 | 99.5 |
| Missing | 2 | .5 |
| Total | 400 | 100.0 |

**13. The BAR classroom training that I received was sufficient to ensure adequate job performance.**

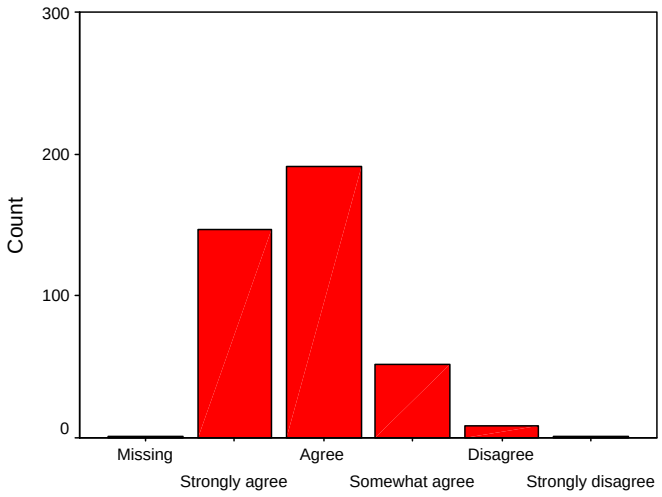
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 117 | 29.3 |
| Agree | 186 | 46.5 |
| Somewhat agree | 76 | 19.0 |
| Disagree | 16 | 4.0 |
| Strongly disagree | 3 | .8 |
| Subtotal | 398 | 99.5 |
| Missing | 2 | .5 |
| Total | 400 | 100.0 |




Q13 BAR classroom trng suff to ensure adeq job perf

**14. The books and other printed material used during the BAR courses were adequate for the training provided to me.**

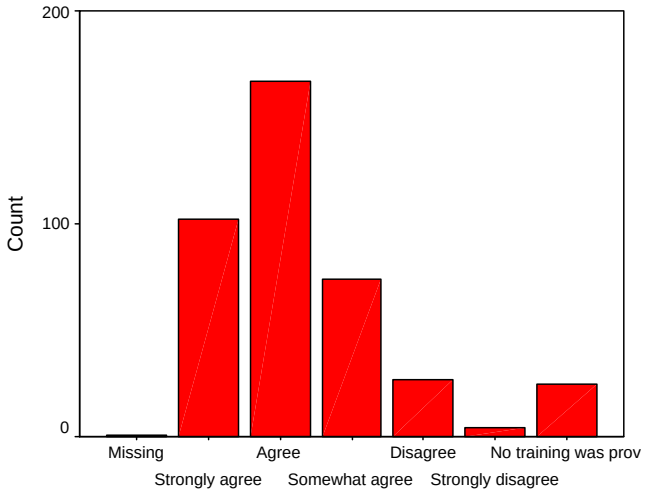
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 147 | 36.8 |
| Agree | 191 | 47.8 |
| Somewhat agree | 52 | 13.0 |
| Disagree | 8 | 2.0 |
| Strongly disagree | 1 | .3 |
| Subtotal | 399 | 99.8 |
| Missing | 1 | .3 |
| Total | 400 | 100.0 |




Q14 Bks and other print mat used in BAR courses adequate

**15. During the BAR courses, the online resources (Manufacturer Internet websites, Mitchell-On-Demand, AllData, etc.) were explained to me in a manner that I can now apply this knowledge to emission failure repairs.**

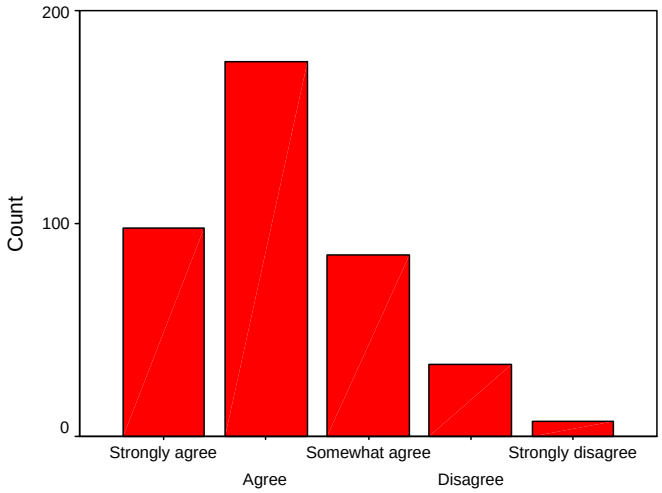
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 102 | 25.5 |
| Agree | 167 | 41.8 |
| Somewhat agree | 74 | 18.5 |
| Disagree | 27 | 6.8 |
| Strongly disagree | 4 | 1.0 |
| No training was provided | 25 | 6.3 |
| Subtotal | 399 | 99.8 |
| Missing | 1 | .3 |
| Total | 400 | 100.0 |




Q15 Online resources explained to me apply to repairs

**16. The amount of hands-on training that I received during the BAR courses was adequate to prepare me for the job.**

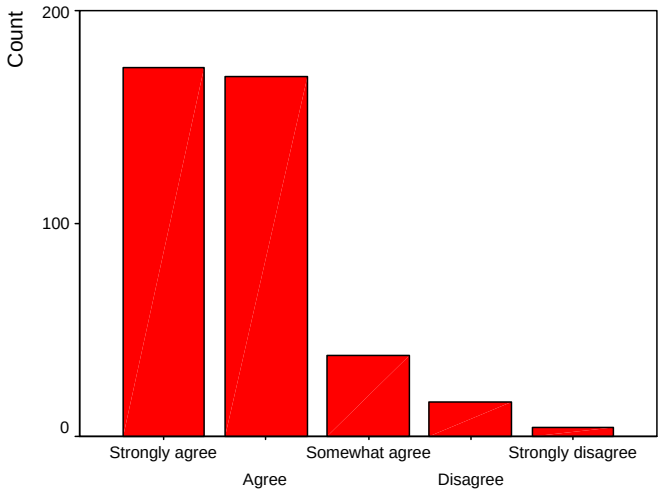
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 98 | 24.5 |
| Agree | 176 | 44.0 |
| Somewhat agree | 85 | 21.3 |
| Disagree | 34 | 8.5 |
| Strongly disagree | 7 | 1.8 |
| Total | 400 | 100.0 |




Q16 Amt of hands on trng recd adeq to prep me for the job

**17. During my BAR training courses, there was sufficient equipment (DSOs, DVOMs, etc.) to conduct the hands-on (laboratory) exercises.**

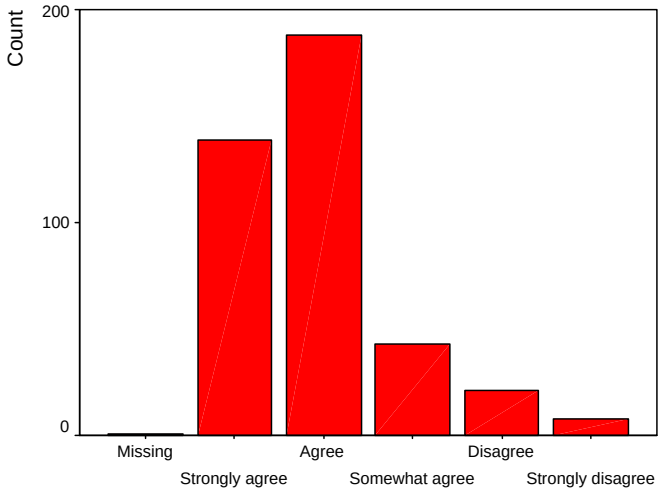
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 173 | 43.3 |
| Agree | 169 | 42.3 |
| Somewhat agree | 38 | 9.5 |
| Disagree | 16 | 4.0 |
| Strongly disagree | 4 | 1.0 |
| Total | 400 | 100.0 |




Q17 Sufficient equipment to conduct hands on exercises

**18. During my BAR training courses, there were sufficient demonstration vehicles to conduct the hands-on laboratory exercises.**

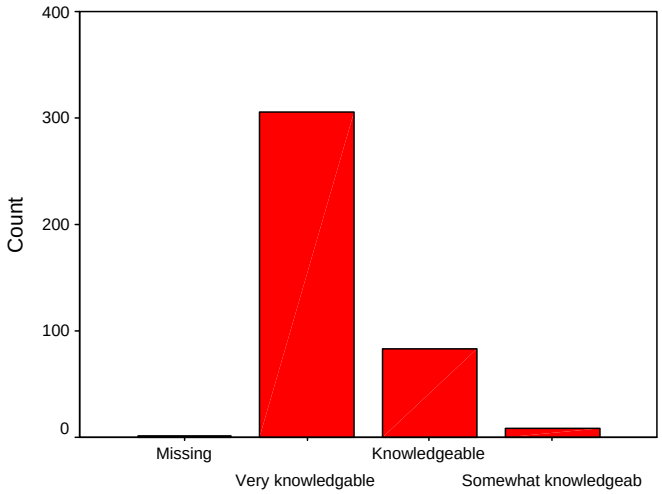
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 139 | 34.8 |
| Agree | 188 | 47.0 |
| Somewhat agree | 43 | 10.8 |
| Disagree | 21 | 5.3 |
| Strongly disagree | 8 | 2.0 |
| Subtotal | 399 | 99.8 |
| Missing | 1 | .3 |
| Total | 400 | 100.0 |




Q18 Sufficient demo vehicles to conduct hands on exercises

## 19. On average, how knowledgeable was your BAR instructor?

| | Frequency | Percent |
|---|---|---|
| Very knowledgable | 306 | 76.5 |
| Knowledgeable | 83 | 20.8 |
| Somewhat knowledgeable | 9 | 2.3 |
| Subtotal | 398 | 99.5 |
| Missing | 2 | .5 |
| Total | 400 | 100.0 |




Q19 How knowledgable was your BAR instructor

**20. On average, did your instructor ask for feedback from the students during the course(s) you attended?**

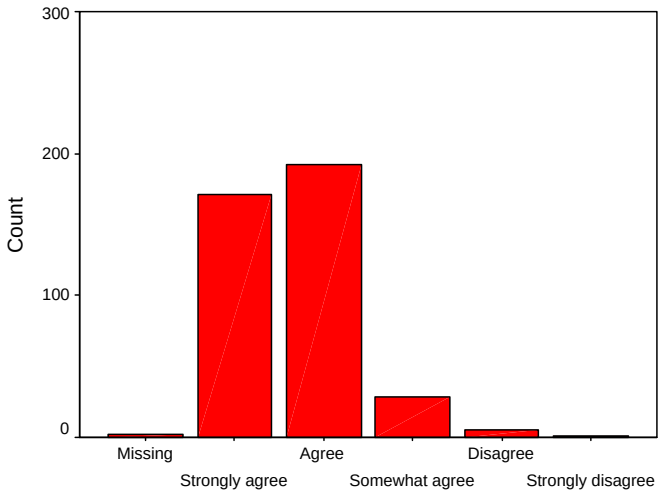
| | Frequency | Percent |
|---|---|---|
| Yes | 360 | 90.0 |
| No | 36 | 9.0 |
| Subtotal | 396 | 99.0 |
| Missing | 4 | 1.0 |
| Total | 400 | 100.0 |

**21. On average, did your instructor ask questions of the students to see if his/her lecture points were understood during the courses you attended?**

| | Frequency | Percent |
|---|---|---|
| Yes | 379 | 94.8 |
| No | 19 | 4.8 |
| Subtotal | 398 | 99.5 |
| Missing | 2 | .5 |
| Total | 400 | 100.0 |

**22. The training I received regarding California's (Smog Check Program) laws and regulations was sufficient.**

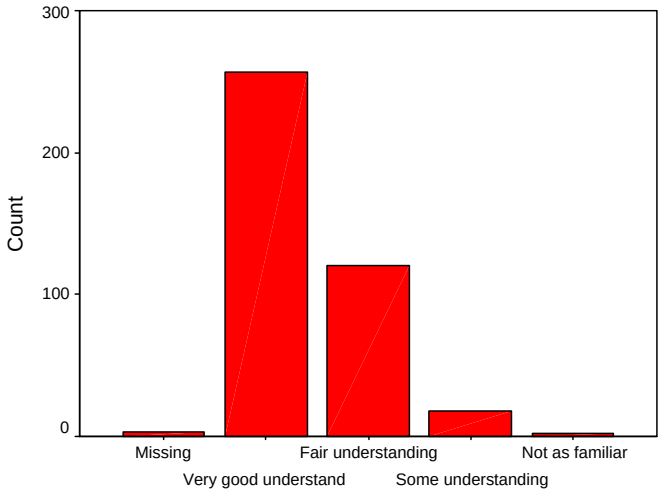
| | Frequency | Percent |
|---|---|---|
| Strongly agree | 171 | 42.8 |
| Agree | 192 | 48.0 |
| Somewhat agree | 29 | 7.3 |
| Disagree | 5 | 1.3 |
| Strongly disagree | 1 | .3 |
| Subtotal | 398 | 99.5 |
| Missing | 2 | .5 |
| Total | 400 | 100.0 |




Q22 Training recd re Calif laws and regs was sufficient

**23. How would you characterize your understanding of basic automotive electrical/electronic systems (e.g., wiring schematics, Ohms law, series/parallel circuits, DVOM usage, voltage drop testing, etc.)?**

| | Frequency | Percent |
|---|---|---|
| Very good understanding | 257 | 64.3 |
| Fair understanding | 120 | 30.0 |
| Some understanding | 18 | 4.5 |
| Not as familiar | 2 | .5 |
| Subtotal | 397 | 99.3 |
| Missing | 3 | .8 |
| Total | 400 | 100.0 |



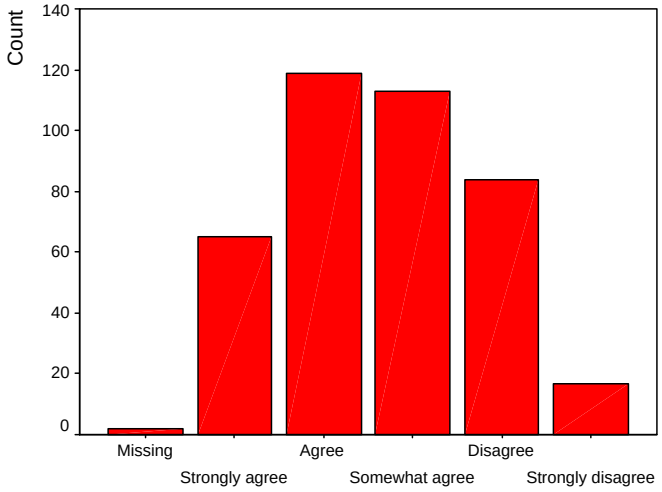

Q23 How would you char your underst of basic auto system

**24. What additional training do you feel would have benefited you in your job performance? (Check all that apply)**

| | |
|---|---|
| Step-by-step diagnostic procedures to identify causes of emission failures | 162 |
| Theory and operation of CAN systems | 137 |
| Advanced scan tool usage | 131 |
| Application of Mode 6 information | 128 |
| On-Board Diagnostic (OBD) II Fuel EVAP systems theory, operation and testing | 109 |
| Fuel trim/adaptive strategy | 105 |
| Smog Check Program rules and regulations | 93 |
| How to conduct a Smog Check inspection | 88 |
| Lambda calculations | 90 |
| BAR-97 EIS usage | 69 |
| Theory and operation of Emission Control Systems (ECS) | 86 |
| Proper use of diagnostic repair manuals | 67 |
| Theory and operation of sensors and actuators | 63 |
| Basic electrical systems | 53 |
| Basic engine theory and testing procedures | 55 |
| Theory and operation of ignition systems | 56 |
| Theory and operation of fuel systems | 52 |

**25. Additional training modules are necessary to prepare me to perform emission-related diagnosis and repairs.**

| | Frequency | Percent |
|---|---|---|
| Strongly agree | 65 | 16.3 |
| Agree | 119 | 29.8 |
| Somewhat agree | 113 | 28.3 |
| Disagree | 84 | 21.0 |
| Strongly disagree | 17 | 4.3 |
| Subtotal | 398 | 99.5 |
| Missing | 2 | .5 |
| Total | 400 | 100.0 |




Q25 Additional trng modules necessary

**26. Have you participated in non-BAR training courses that used the Internet for teaching purposes?**

| | Frequency | Percent |
|---|---|---|
| Yes | 95 | 23.8 |
| No | 304 | 76.0 |
| Subtotal | 399 | 99.8 |
| Missing | 1 | .3 |
| Total | 400 | 100.0 |

**27. Did your non-BAR training courses use the Internet for "distance learning" outside of the classroom setting?**

| | Frequency | Percent |
|---|---|---|
| Yes | 81 | 20.3 |
| No | 271 | 67.8 |
| Subtotal | 352 | 88.0 |
| Missing | 48 | 12.0 |
| Total | 400 | 100.0 |

**28. Which of the following age groups best describes your current age?**

| | Frequency | Percent |
|---|---|---|
| 18 to 24 years | 84 | 21.0 |
| 25 to 34 years | 126 | 31.5 |
| 35 to 50 years | 141 | 35.3 |
| 51 years and older | 49 | 12.3 |
| Total | 400 | 100.0 |

# APPENDIX C: OWNER/SUPERVISOR ASSESSMENT

**1. What type of facility is your station? (Check all that apply)**

| | |
|---|---|
| Test-only | 157 |
| Test and Repair | 246 |
| Gold Shield | 50 |
| Private fleets (as designated by BAR) | 2 |

**2. How many years has your facility been performing Smog Check inspections?**

| | Frequency | Percent |
|---|---|---|
| Less than 1 yr | 25 | 5.6 |
| 1 to 5 yrs | 135 | 30.2 |
| 6 to 9 yrs | 75 | 16.8 |
| 10 to 20 yrs | 147 | 32.9 |
| More than 20 yrs | 65 | 14.5 |
| Total | 447 | 100.0 |

**3. How many Smog Check technicians have you employed over the last year?**

| | Frequency | Percent |
|---|---|---|
| Just myself | 227 | 50.8 |
| 1 to 2 technicians | 181 | 40.5 |
| 3 to 5 technicians | 32 | 7.2 |
| 6 or more technicians | 7 | 1.6 |
| Total | 447 | 100.0 |

**4. If your facility repairs vehicles, approximately how many Smog Check repairs does your facility perform monthly?**

| | Frequency | Percent |
|---|---|---|
| Does not apply | 155 | 34.7 |
| 1 to 3 repairs | 75 | 16.8 |
| 4 to 7 repairs | 81 | 18.1 |
| 8 to 12 repairs | 57 | 12.8 |
| 13 or more repairs | 79 | 17.7 |
| Total | 447 | 100.0 |

**5. Does your station have a computer that technicians actively use to access the Internet so they can obtain information from manufacturer websites or online resources (e.g., Mitchell-On-Demand, AllData, etc.)?**

| | Frequency | Percent |
|---|---|---|
| Yes | 340 | 76.1 |
| No | 107 | 23.9 |
| Total | 447 | 100.0 |

**6. For each of the following, mark an "X" under either "Strong" or "Weak" to indicate whether you believe the Smog Check technician(s) at your facility have a relatively strong or weak understanding of each knowledge area.**

**"Strong" indicates technician has competency in this area**

**"Weak" indicates more training may be needed.**

**"Does Not Apply" indicates a knowledge area does not apply to the work at the respondents' facility**

| Knowledge Area | Strong | Weak | Does Not Apply |
|---|---|---|---|
| Electrical/electronic system theory, operation, diagnosis and repair | 321 | 43 | 83 |
| Engine theory and testing procedures | 376 | 16 | 55 |
| Engine performance | 373 | 19 | 55 |
| Theory, operations, and identification of Emission Control Systems (ECS) | 412 | 18 | 17 |
| Proper use of diagnostic repair manuals | 345 | 25 | 77 |
| On-Board Diagnostic (OBD) II theory, operation and testing | 361 | 39 | 47 |
| Scan tool usage | 337 | 47 | 63 |
| Acceleration Simulation Mode (ASM) testing | 396 | 15 | 36 |
| Two-speed idle (TSI) testing | 433 | 8 | 6 |
| Gauging stoichiometry to diagnose emission failures (Lambda calculator, fuel trim data, stoichiometric chart, 5-gas analysis) | 260 | 94 | 93 |
| Smog Check Program Rules and Regulations | 402 | 40 | 5 |

# APPENDIX D: TECHNICIAN NEEDS ASSESSMENT

1. **Where did you obtain your BAR training? (Check all that apply)**

| | |
|---|---|
| Private vocational school | 40 |
| Community college | 46 |
| Occupational center | 13 |
| Regional Opportunity Program (ROP) | 1 |
| Other | 9 |

2. **Where did you obtain the greatest amount of experience in emission-related (Smog Check) inspections and/or repairs?**

| | Frequency | Percent |
|---|---|---|
| At a test-only station | 2 | 2.4 |
| Licensed Test and Repair facility including Gold Shield | 76 | 89.4 |
| Licensed fleet facility | 2 | 2.4 |
| Not currently employed in auto repair field | 1 | 1.2 |
| Other | 4 | 4.7 |
| Total | 85 | 100.0 |

3. **How many years have you been a licensed Smog Check Technician?**

| | Frequency | Percent |
|---|---|---|
| 1 to 5 yrs | 7 | 8.2 |
| 6 to 10 yrs | 12 | 14.1 |
| 11 or more yrs | 65 | 76.5 |
| Not a Smog Check Technician | 1 | 1.2 |
| Total | 85 | 100.0 |

4. **What National Institute of Automotive Service Excellence (ASE) certifications do you hold? (Check all that apply. Do not include the BAR ASE Alternative courses.)**

| Certification | |
|---|---|
| Automotive Electrical/Electronic systems (A6) | 72 |
| Automotive Engine Performance (A8) | 75 |
| Automotive Advanced Engine Performance Specialist (L1) | 67 |
| None | 7 |
| Other | 36 |

**5. How much automotive trade experience did you have <u>prior</u> to starting your first BAR course?**

| | Frequency | Percent |
|---|---|---|
| No automotive trade experience | 7 | 8.2 |
| 6 mo to 1 yr | 1 | 1.2 |
| 1 to 2 yrs | 11 | 12.9 |
| 2 to 5 yrs | 20 | 23.5 |
| More than 5 yrs | 46 | 54.1 |
| Total | 85 | 100.0 |

**6. How many automotive training courses did you complete <u>prior</u> to starting your first BAR course?**

| | Frequency | Percent |
|---|---|---|
| No auto courses prior to first BAR course | 20 | 23.5 |
| 1 to 2 courses | 8 | 9.4 |
| 3 courses | 9 | 10.6 |
| 4 courses | 12 | 14.1 |
| 5 courses | 5 | 5.9 |
| More than 5 courses | 31 | 36.5 |
| Total | 85 | 100.0 |

**7. Which of the following BAR ASE Alternative courses, if any, have you completed? (Check all that apply)**

| Course | |
|---|---|
| Automotive Electrical/Electronic systems (A6 alternative) | 33 |
| Automotive Engine Performance (A8 alternative) | 31 |
| Automotive Advanced Engine Performance Specialist (L1 alternative) | 46 |
| None | 37 |

**Rating scale**

When should a technician, new to Smog Check, acquire competence in this task?

0 - Not part of my job
1 - During industry experience before licensure
2 - During required coursework and/or training before licensure
3 - During industry experience after licensure
4 - During BAR update training or other training after licensure

**Ratings of commonly performed tasks**

| Item | | When Acquired[3] |
|---|---|---|
| | I. Consumer Consultation | |
| T10. | Inform consumer of available assistance programs in event of inspection failure. | 2.45 |
| T5. | Inform the consumer of vehicle smog check results by explaining the vehicle inspection report (VIR) to the consumer. | 2.44 |
| T9. | Inform consumer of need for retest following repairs made to vehicle. | 2.27 |
| T8. | Obtain consumer authorization to perform repairs on vehicle as determined by diagnostic testing. | 2.14 |
| T7. | Obtain consumer authorization to conduct diagnostic testing of vehicle when vehicle fails smog check inspection. | 2.12 |
| T1. | Determine type of smog check inspection to be performed on vehicle (e.g., initial registration, renew registration, change of ownership, test-only). | 2.09 |
| T4. | Inform consumer of the option for an official pretest smog check inspection. | 2.00 |
| T6. | Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs. | 1.98 |
| T2. | Determine if vehicle requires a smog check by evaluating vehicle information prior to performing smog check inspection. | 1.95 |
| T3. | Prepare work order to document smog check inspection to be performed and obtain consumer authorization. | 1.94 |
| | II. Vehicle Inspection | |
| T13. | Determine if vehicle is required to be tested at a specific type of station (e.g., referee, Gold Shield). | 2.34 |

[3] Assumes a cutoff value of 2.5 on a four-point rating scale (1= during industry experience before licensure, 2 = during required coursework before licensure, 3 = during industry experience after licensure, and 4 = during BAR Update training or other training after licensure).

| Item | | When Acquired[3] |
|---|---|---|
| T14. | Determine type of vehicle certification to evaluate vehicle emission label (e.g., California, Federal, BAR label). | 2.30 |
| T11. | Determine accuracy of DMV renewal notice and vehicle information prior to performing smog check inspection (e.g., VIN label, license number). | 2.22 |
| T12. | Evaluate vehicle emission label to determine vehicle emission control requirements. | 2.21 |
| | III. Safety Precautions | |
| T19. | Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety. | 2.35 |
| T20. | Secure vehicle during emissions inspection (e.g., two speed idle) by setting the emergency brake or chocks. | 2.26 |
| T18. | Follow recommended safety procedures of vehicle and equipment manufacturers while servicing vehicle (e.g., inspection, diagnosis, repair). | 2.06 |
| T15. | Determine if minor repairs need to be performed on vehicle to ensure safety during smog check inspection (e.g., loose hose clamp, tire conditions). | 2.05 |
| T17. | Maintain safety of testing area by keeping area clean. | 1.99 |
| T16. | Perform minor repairs on vehicle if needed during safety inspection (e.g., tighten loose hose clamp). | 1.95 |
| | IV. Calibration of Analyzer and Devices | |
| T25. | Perform troubleshooting procedures on evaporative pressure test (LPEFT) equipment to restore correct function. | 2.62 |
| T22. | Inspect analyzer devices to ensure accurate functioning during smog check inspection or replace if needed. | 2.52 |
| T26. | Inspect dynamometer to ensure safe operation prior to performing calibration. | 2.49 |
| T21. | Perform calibration of emissions testing equipment to ensure accurate functioning during smog check inspection. | 2.47 |
| T23. | Perform troubleshooting procedures on analyzer sample system to restore correct function. | 2.47 |
| T24. | Perform troubleshooting procedures on fuel cap test devices to restore correct function. | 2.44 |
| T27. | Perform troubleshooting procedures on dynamometer to restore correct function. | 2.36 |
| | V. Emission Test Procedures | |
| T37. | Perform acceleration simulation mode (ASM) test as prompted by analyzer to measure vehicle emissions. | 2.58 |
| T33. | Perform two speed idle (TSI) test if prompted by analyzer. | 2.57 |
| T34. | Remove analyzer devices from vehicle following emission inspection as prompted by analyzer. | 2.57 |

| Item | | When Acquired[3] |
|---|---|---|
| T30. | Enter technician access code into analyzer to validate technician authorization. | 2.55 |
| T31. | Prepare for emissions inspection by following analyzer prompts (e.g., insert probe, attach RPM pickup, enter vehicle information, restrain vehicle, cooling fan). | 2.51 |
| T32. | Perform pretest smog check inspection on vehicle if authorized by consumer. | 2.51 |
| T35. | Determine placement of vehicle on dynamometer prior to performing emission inspection (e.g., front wheel drive, rear wheel drive). | 2.51 |
| T29. | Select vehicle gear as prompted by the analyzer during emissions testing. | 2.50 |
| T36. | Weigh vehicle as prompted by the emissions analyzer to set load of dynamometer. | 2.48 |
| T28. | Prepare vehicle for emission inspection by warming engine to normal operating temperature prior to performing emission inspection. | 2.33 |
| | VI. Visual Inspection | |
| T50. | Perform visual inspection of vehicle to determine presence of excessive smoke (e.g., tailpipe, crankcase). | 2.51 |
| T49. | Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle. | 2.39 |
| T43. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of fuel evaporative (EVAP) system on vehicle. | 2.33 |
| T41. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of thermostatic air cleaner (TAC) system on vehicle. | 2.32 |
| T38. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of positive crankcase ventilation (PCV) system on vehicle. | 2.29 |
| T40. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of exhaust gas recirculation (EGR) system on vehicle. | 2.27 |
| T42. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of air injection (AIS) system on vehicle. | 2.27 |
| T46. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks. | 2.27 |
| T39. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of catalytic converter system on vehicle. | 2.26 |
| T44. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control systems on vehicle. | 2.26 |

| Item | | When Acquired[3] |
|---|---|---|
| T47. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of sensors, switches, and computers on vehicle. | 2.26 |
| T48. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of other emission-related components on vehicle. | 2.25 |
| T45. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle. | 2.24 |
| | VII. Functional Tests | |
| T57. | Perform evaporative pressure test as required. | 2.59 |
| T52. | Perform OBD II test as prompted by the analyzer. | 2.44 |
| T56. | Perform functional test of fuel cap as prompted by the analyzer. | 2.39 |
| T55. | Perform functional test of the fillpipe restrictors when prompted by the analyzer. | 2.27 |
| T54. | Perform functional test of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures. | 2.24 |
| T51. | Perform functional test of vehicle's malfunction indicator light (MIL) as prompted by the analyzer. | 2.18 |
| T53. | Perform ignition timing check as prompted by the analyzer by following manufacturer procedures. | 2.14 |
| | VIII. Diagnosis | |
| T59. | Perform baseline test on vehicle to verify failure identified on vehicle inspection report (VIR) prior to diagnosing failure. | 2.55 |
| T60. | Inspect vehicle emission systems to determine if failure was due to physical condition of systems. | 2.45 |
| T58. | Evaluate vehicle inspection report (VIR) to identify areas that indicate vehicle failure. | 2.44 |
| T63. | Evaluate diagnostic readings to determine if a system failure may be causing other systems to fail. | 2.42 |
| T62. | Perform diagnostic testing on vehicle systems as indicated by failure analysis. | 2.39 |
| T61. | Evaluate emissions results (e.g., excessive HC, excessive CO) to identify systems in vehicle that need diagnostic testing. | 2.36 |
| | IX. Performing and Verifying Repairs | |
| T66. | Perform pre-inspection prior to retest to verify that repair is successful. | 2.55 |
| T64. | Evaluate diagnostic testing results to determine if components of vehicle systems need to be cleaned, repaired, or replaced. | 2.52 |

| Item | | When Acquired[3] |
|---|---|---|
| T65. | Replace, repair or clean out components of vehicle systems as indicated by vehicle diagnosis. | 2.47 |

# APPENDIX E: KNOWLEDGE BASE

| | |
|---|---|
| K1. | Knowledge of procedures performed during smog check inspection. |
| K2. | Knowledge of laws and regulations requiring vehicles to receive a smog check inspection. |
| K3. | Knowledge base used to obtain information from consumers regarding type of smog check inspection needed. |
| K4. | Knowledge of information required to determine if a vehicle requires smog check inspection. |
| K5. | Knowledge of laws and regulations requiring vehicles to be tested at a test-only station. |
| K6. | Knowledge of procedures used to inform consumers about the purpose of performing smog check inspection (e.g., emission control, air pollution). |
| K7. | Knowledge of laws and regulations regarding educating consumers about repair cost waivers. |
| K8. | Knowledge of laws and regulations regarding educating consumers about economic hardship extensions when vehicle fails smog check inspection. |
| K9. | Knowledge of purposes for referring consumers to referee stations (e.g., engine change, SPCNS). |
| K10. | Knowledge of required information used to prepare work orders for smog check inspection. |
| K11. | Knowledge of laws and regulations requiring consumer authorization for smog check inspection. |
| K12. | Knowledge of reasons for informing consumers about the option of a pretest smog check inspection. |
| K13. | Knowledge of required procedures if a consumer wants pretest smog check inspection. |
| K14. | Knowledge of type of information provided in vehicle inspection report (VIR). |
| K15. | Knowledge of purpose for providing consumer with vehicle inspection report (VIR). |
| K16. | Knowledge of types of repairs that can be considered minor repairs. |
| K17. | Knowledge of procedures used to determine if vehicle needs minor repairs before performing smog check inspection. |

| | |
|---|---|
| K18. | Knowledge of laws and regulations regarding performing minor repairs on vehicles. |
| K19. | Knowledge of purposes for performing minor repairs on vehicles. |
| K20. | Knowledge of information to provide consumers regarding state assistance programs (e.g., CAP repair assistance and vehicle retirement). |
| K21. | Knowledge of procedures used to assist consumer in understanding the vehicle inspection report (VIR). |
| K22. | Knowledge of information provided to consumers about retesting a vehicle following repairs. |
| K23. | Knowledge of methods used to determine if smog check inspection of a vehicle needs to be performed at test-only station. |
| K24. | Knowledge of methods used to determine if vehicle repairs are covered under warranty. |
| K25. | Knowledge of information necessary to inform consumer of possible warranty coverage. |
| K26. | Knowledge of laws and regulations about performing diagnostic testing on vehicles. |
| K27. | Knowledge of purposes for performing diagnostic testing on vehicles. |
| K28. | Knowledge of laws and regulations requiring consumer authorization for performing diagnostic testing on vehicles. |
| K29. | Knowledge of procedures used to recommend vehicle repairs to consumers. |
| K30. | Knowledge of laws and regulations regarding providing consumers with vehicle repair cost estimates. |
| K31. | Knowledge of laws and regulations regarding performing repairs on vehicles. |
| K32. | Knowledge of laws and regulations requiring consumer authorization for performing repairs on vehicles. |
| K33. | Knowledge of purpose for performing retest on a vehicle following repairs. |
| K34. | Knowledge of laws and regulations for providing contact information for stations that diagnose and repair vehicles. |
| K35. | Knowledge of purposes for reviewing DMV renewal notices. |
| K36. | Knowledge of procedures used to verify vehicle information prior to performing smog check inspection. |

| | |
|---|---|
| K37. | Knowledge of information used to determine type of vehicle certification (e.g., California, Federal, BAR label). |
| K38. | Knowledge of information to provide to consumers when vehicle does not conform to emissions certifications (i.e., Gray Market). |
| K39. | Knowledge of laws and regulations requiring vehicles to receive smog check inspection at a specific type of station (e.g., referee, Gold Shield). |
| K40. | Knowledge of references used to identify a vehicle that does not have an emissions label. |
| K41. | Knowledge of purposes for verifying vehicle safety prior to performing smog check inspection. |
| K42. | Knowledge of procedures used to identify unsafe vehicle conditions. |
| K43. | Knowledge of information to provide consumers about unsafe vehicle condition(s). |
| K44. | Knowledge base used to differentiate between minor and major vehicle repairs. |
| K45. | Knowledge of procedures used during smog check inspection if vehicle safety standards are not acceptable. |
| K46. | Knowledge of informing consumers of minor repairs that needed to be made to vehicle. |
| K47. | Knowledge of purposes for performing minor repairs to a vehicle during safety check. |
| K48. | Knowledge of procedures used to perform minor repairs to a vehicle. |
| K49. | Knowledge of laws and regulations about stations performing minor repairs on vehicles to ensure safe test conditions. |
| K50. | Knowledge of types of references used to assist a technician in performing minor repairs to a vehicle. |
| K51. | Knowledge of regulations requiring clean inspection area. |
| K52. | Knowledge of types of equipment used during smog check inspection that could harm consumer, staff, and technician. |
| K53. | Knowledge of procedures used to operate equipment during smog check inspection. |
| K54. | Knowledge of references used to inform technician of equipment operation. |

| | |
|---|---|
| K55. | Knowledge of vehicle problems leading to smog check inspection being aborted. |
| K56. | Knowledge of methods used to verify function of fuel cap test device(s). |
| K57. | Knowledge of procedures used to calibrate fuel cap test device(s). |
| K58. | Knowledge of methods used to verify function of analyzer component(s) (i.e., RPM, probe). |
| K59. | Knowledge of types of analyzer components(s) (i.e., RPM, probe) used during smog check inspection. |
| K60. | Knowledge of procedures used to inspect and maintain analyzer maintenance components. |
| K61. | Knowledge of procedures used to troubleshoot analyzer system. |
| K62. | Knowledge of types of references used by technician to troubleshoot analyzer system. |
| K63. | Knowledge of references and procedures used to troubleshoot fuel cap integrity test device(s). |
| K64. | Knowledge of methods used to troubleshoot on-line phone connection. |
| K65. | Knowledge of methods used to verify operation of dynamometer. |
| K66. | Knowledge of components of a dynamometer. |
| K67. | Knowledge of references and procedures used to troubleshoot dynamometer. |
| K68. | Knowledge of procedures used to prepare vehicle for performing an emissions test. |
| K69. | Knowledge of purposes for warming vehicle engine prior to performing an emissions inspection. |
| K70. | Knowledge of procedures used to secure vehicle while performing a two-speed idle test. |
| K71. | Knowledge base used to validate technician access to EIS to perform smog check inspection. |
| K72. | Knowledge for verifying weight classification of vehicle. |
| K73. | Knowledge of procedures used to enter vehicle information. |
| K74. | Knowledge of type of vehicle information used to prepare for an emissions inspection. |

| | |
|---|---|
| K75. | Knowledge of device(s) used to sample vehicle exhaust system. |
| K76. | Knowledge of device(s) used to detect engine rpm. |
| K77. | Knowledge of purposes and procedures for performing pretest smog check inspection. |
| K78. | Knowledge of procedures used to perform two-speed idle (TSI) test. |
| K79. | Knowledge of procedures used following the completion of emission inspection. |
| K80. | Knowledge of equipment used to prevent vehicle from overheating during an acceleration simulation mode (ASM) test. |
| K81. | Knowledge of proper placement of vehicle on dynamometer. |
| K82. | Knowledge of procedures and purpose used to place and secure vehicle onto dynamometer. |
| K83. | Knowledge of types of equipment used to secure vehicle onto dynamometer. |
| K84. | Knowledge of procedures used to weigh vehicle on dynamometer. |
| K85. | Knowledge of procedures used to perform acceleration simulation mode (ASM) test. |
| K86. | Knowledge of procedures used to keep vehicle speed stabilized during acceleration simulation mode (ASM) test. |
| K87. | Knowledge of methods used to evaluate installation of positive crankcase ventilation (PCV) system. |
| K88. | Knowledge of methods used to verify condition of required hoses in positive crankcase ventilation (PCV) system. |
| K89. | Knowledge of types of references used to identify components of the positive crankcase ventilation (PCV) system. |
| K90. | Knowledge of methods used to evaluate installation of catalytic converter system. |
| K91. | Knowledge of types of external damage caused to catalytic converter system. |
| K92. | Knowledge of methods used to evaluate installation of exhaust gas recirculation (EGR) system. |
| K93. | Knowledge of methods used to verify condition of thermal vacuum switches in exhaust gas recirculation (EGR) system. |

| | |
|---|---|
| K94. | Knowledge of methods used to verify condition of pressure transducers in exhaust gas recirculation (EGR) system. |
| K95. | Knowledge of methods used to verify condition of speed switches in exhaust gas recirculation (EGR) system. |
| K96. | Knowledge of methods used to verify condition of computer-operated solenoids in exhaust gas recirculation (EGR) system. |
| K97. | Knowledge of methods used to verify condition of vacuum regulating valves in exhaust gas recirculation (EGR) system. |
| K98. | Knowledge of methods used to verify condition of vacuum hoses in exhaust gas recirculation (EGR) system. |
| K99. | Knowledge of types of references used to identify components of the exhaust gas recirculation (EGR) system. |
| K100. | Knowledge base used to evaluate installation and components of thermostatic air cleaner (TAC) system. |
| K101. | Knowledge base used to verify condition of heat delivery pipes and heat stoves in thermostatic air cleaner (TAC) system. |
| K102. | Knowledge base used to verify condition of thermal vacuum switches and vacuum hoses in thermostatic air cleaner (TAC) system. |
| K103. | Knowledge of reference materials used to identify components of the thermostatic air cleaner (TAC) system. |
| K104. | Knowledge base used to evaluate installation and conditions of components of air injection (AIS) system. |
| K105. | Knowledge base used to verify condition of air pump in air injection (AIS) system. |
| K106. | Knowledge base used to verify condition of valve(s) in air injection (AIS) system. |
| K107. | Knowledge base used to verify condition of electrical components in air injection (AIS) system. |
| K108. | Knowledge base used to verify condition of vacuum signal lines in air injection (AIS) system. |
| K109. | Knowledge base used to verify routing of distribution hoses in air injection (AIS) system. |

| | |
|---|---|
| K110. | Knowledge of reference materials used to identify components of the air injection (AIS) system. |
| K111. | Knowledge base used to evaluate installation and condition of components of fuel evaporative (EVAP) system. |
| K112. | Knowledge base used to verify condition of vapor storage canister in fuel evaporative (EVAP) system. |
| K113. | Knowledge base used to verify condition of hoses in fuel evaporative (EVAP) system. |
| K114. | Knowledge base used to verify condition of solenoids in fuel evaporative (EVAP) system. |
| K115. | Knowledge base used to determine the type of fuel tank cap in fuel evaporative (EVAP) system. |
| K116. | Knowledge base used to verify condition of thermal vacuum switches in fuel evaporative (EVAP) system. |
| K117. | Knowledge of reference materials used to identify components of the fuel evaporative (EVAP) system. |
| K118. | Knowledge base used to evaluate installation of ignition spark control system(s). |
| K119. | Knowledge of components used in the ignition spark control system(s). |
| K120. | Knowledge base used to verify condition of thermal vacuum switches in ignition spark control system(s). |
| K121. | Knowledge base used to verify condition of TCS switches in ignition spark control system(s). |
| K122. | Knowledge base used to verify condition of sensors in ignition spark control system(s). |
| K123. | Knowledge base used to verify condition of spark delay valves in ignition spark control system(s). |
| K124. | Knowledge of reference materials used to identify components of the ignition spark control system(s). |
| K125. | Knowledge base used to evaluate installation of fuel induction system. |
| K126. | Knowledge of components used in the fuel induction system. |
| K127. | Knowledge base used to verify condition of hoses and lines used in the fuel induction system. |

| | |
|---|---|
| K128. | Knowledge base used to verify condition of wiring in fuel induction system. |
| K129. | Knowledge base used to verify condition of carburetor in fuel induction system. |
| K130. | Knowledge base used to verify condition of fuel injection system. |
| K131. | Knowledge of reference materials used to identify components of the fuel induction system. |
| K132. | Knowledge base used to identify liquid fuel leaks. |
| K133. | Knowledge base used to evaluate installation and condition of sensors, switches, and computers. |
| K134. | Knowledge of types of sensors, switches, and computers in vehicle. |
| K135. | Knowledge base used to verify condition of wiring. |
| K136. | Knowledge of reference materials used to identify sensors, switches, and computers of vehicle. |
| K137. | Knowledge base used to identify installation and condition of other vehicle emission related components. |
| K138. | Knowledge of reference materials used to identify other vehicle emissions related components that are permitted. |
| K139. | Knowledge of purposes for verifying emission components of a vehicle. |
| K140. | Knowledge of reference materials used to identify required emission controlled components of a vehicle. |
| K141. | Knowledge of requirements for vehicles that consist of additional components (e.g., auxiliary fuel tank) other than the specified equipment of the vehicle. |
| K142. | Knowledge of reference materials used to identify approved substitute emission components (e.g., CARB, Appendix K). |
| K143. | Knowledge base used to verify function of malfunction indicator light (MIL). |
| K144. | Knowledge of purpose and procedures for performing OBD II functional test. |
| K145. | Knowledge of procedures used to verify vehicle ignition timing. |
| K146. | Knowledge of vehicle ignition timing parameters indicating smog check inspection failure. |
| K147. | Knowledge of vehicles that are exempt from ignition timing functional test. |
| K148. | Knowledge of purposes for performing ignition timing functional test. |

| | |
|---|---|
| K149. | Knowledge of vehicles that require exhaust gas recirculation (EGR) functional test. |
| K150. | Knowledge of purpose and procedures used to verify function of exhaust gas recirculation (EGR) system. |
| K151. | Knowledge base used to verify function of fillpipe restrictors. |
| K152. | Knowledge base used to perform fuel cap functional test. |
| K153. | Knowledge of vehicles that require fuel cap functional test. |
| K154. | Knowledge for performing fuel cap functional test. |
| K155. | Knowledge base used to identify areas of failure on vehicle inspection report (VIR). |
| K156. | Knowledge base used to interpret vehicle inspection report (VIR) regarding onboard diagnostic (OBD) systems. |
| K157. | Knowledge base used to interpret vehicle inspection report (VIR) results. |
| K158. | Knowledge of purposes and procedures used to perform a baseline test prior to diagnosing a vehicle. |
| K159. | Knowledge of oxides of nitrogen (NOx) emission levels. |
| K160. | Knowledge of carbon dioxide (CO2) emission levels. |
| K161. | Knowledge of carbon monoxide (CO) emission levels. |
| K162. | Knowledge of oxygen (O2) emission levels. |
| K163. | Knowledge of hydrocarbon (HC) emission levels. |
| K164. | Knowledge of emissions that are considered hazardous. |
| K165. | Knowledge base used to verify condition of vehicle positive crankcase ventilation (PCV) system. |
| K166. | Knowledge base used to verify condition of vehicle catalytic converter system. |
| K167. | Knowledge base used to verify condition of vehicle exhaust gas recirculation (EGR) system. |
| K168. | Knowledge base used to verify condition of vehicle thermostatic air cleaner (TAC) system. |
| K169. | Knowledge base used to verify condition of vehicle air injection (AIS) system. |
| K170. | Knowledge base used to verify condition of vehicle evaporative (EVAP) system. |

| | |
|---|---|
| K171. | Knowledge base used to verify condition of vehicle ignition spark control system(s). |
| K172. | Knowledge base used to verify condition of vehicle fuel induction system. |
| K173. | Knowledge base used to verify condition of vehicle sensors, switches, and computers. |
| K174. | Knowledge base used to verify condition of other related emissions components. |
| K175. | Knowledge of components of vehicle systems that may have been tampered. |
| K176. | Knowledge of components of vehicle systems that may have been damaged. |
| K177. | Knowledge of reference materials used to verify vehicle systems condition. |
| K178. | Knowledge of procedures used to diagnose positive crankcase ventilation (PCV) system. |
| K179. | Knowledge of procedures used to diagnose catalytic converter system. |
| K180. | Knowledge of procedures used to diagnose exhaust gas recirculation (EGR) system. |
| K181. | Knowledge of procedures used to diagnose thermostatic air cleaner (TAC) system. |
| K182. | Knowledge of procedures used to diagnose air injection (AIS) system. |
| K183. | Knowledge of procedures used to diagnose evaporative (EVAP) system. |
| K184. | Knowledge of procedures used to diagnose ignition spark control system(s). |
| K185. | Knowledge of procedures used to diagnose fuel induction system. |
| K186. | Knowledge of procedures used to diagnose sensors, switches, and computers. |
| K187. | Knowledge of procedures used to diagnose other related emissions components. |
| K188. | Knowledge of procedures used to perform onboard diagnostic testing. |
| K189. | Knowledge of reference materials used when performing diagnostic testing on a vehicle. |
| K190. | Knowledge of information from diagnostic testing results indicating vehicle system failures that affect other systems. |
| K191. | Knowledge of relationships between vehicle systems. |

| | |
|---|---|
| K192. | Knowledge of procedures and reference material used to interpret diagnostic readings. |
| K193. | Knowledge of equipment used to perform diagnostic testing procedures. |
| K194. | Knowledge of procedures used to determine type of vehicle repair to be performed. |
| K195. | Knowledge of procedures and equipment used to determine if components need to be cleaned, repaired, or replaced. |
| K196. | Knowledge of procedures used to repair vehicle emission systems. |
| K197. | Knowledge of components of positive crankcase ventilation (PCV) system that need repair. |
| K198. | Knowledge of components of catalytic converter system that need repair. |
| K199. | Knowledge of components of exhaust gas recirculation (EGR) system that need repair. |
| K200. | Knowledge of components of thermostatic air cleaner (TAC) system that need repair. |
| K201. | Knowledge of components of air injection (AIS) system that need repair. |
| K202. | Knowledge of components of evaporative (EVAP) system that need repair. |
| K203. | Knowledge of components of ignition spark control system(s) that need repair. |
| K204. | Knowledge of components of fuel induction system that need repair. |
| K205. | Knowledge of components of sensors, switches, and computers that need repair. |
| K206. | Knowledge of other related vehicle components that need repair. |
| K207. | Knowledge of types of equipment used to repair vehicle system(s). |
| K208. | Knowledge of components of positive crankcase ventilation (PCV) system that need replacement. |
| K209. | Knowledge of components of catalytic converter system that need replacement. |
| K210. | Knowledge of components of exhaust gas recirculation (EGR) system that need replacement. |
| K211. | Knowledge of components of thermostatic air cleaner (TAC) system that need replacement. |

| | |
|---|---|
| K212. | Knowledge of components of air injection (AIS) system need replacement. |
| K213. | Knowledge of components of evaporative (EVAP) system that need replacement. |
| K214. | Knowledge of components of ignition spark control system(s) that need replacement. |
| K215. | Knowledge of components of fuel induction system that need replacement. |
| K216. | Knowledge of components of sensors, switches, and computers that need replacement. |
| K217. | Knowledge of other related vehicle components that need replacement. |
| K218. | Knowledge base used to verify vehicle systems repairs. |
| K219. | Knowledge of purposes and procedures for performing an “after repair” smog check inspection. |

# APPENDIX F: TASK RATINGS – PRIOR TO LICENSURE

In the needs assessment survey (Survey #4), technicians indicated that competency in the majority of the tasks were acquired during industry experience or during required coursework/training before licensure. The findings assist in identifying tasks that technicians would acquire competency during industry training before licensure (Rating = 1) and tasks that technicians would acquire competency during required coursework before licensure (Rating = 2). Tasks with ratings of 1 – 2.5 would be appropriate to include in training before licensure.

Therefore, tasks to be included in prelicensure training are:

| Item | | When Acquired[4] |
|---|---|---|
| T29. | Select vehicle gear as prompted by the analyzer during emissions testing. | 2.50 |
| T26. | Inspect dynamometer to ensure safe operation prior to performing calibration. | 2.49 |
| T36. | Weigh vehicle as prompted by the emissions analyzer to set load of dynamometer. | 2.48 |
| T21. | Perform calibration of emissions testing equipment to ensure accurate functioning during smog check inspection. | 2.47 |
| T23. | Perform troubleshooting procedures on analyzer sample system to restore correct function. | 2.47 |
| T65. | Replace, repair or clean out components of vehicle systems as indicated by vehicle diagnosis. | 2.47 |
| T10. | Inform consumer of available assistance programs in event of inspection failure. | 2.45 |
| T60. | Inspect vehicle emission systems to determine if failure was due to physical condition of systems. | 2.45 |
| T5. | Inform the consumer of vehicle smog check results by explaining the vehicle inspection report (VIR) to the consumer. | 2.44 |
| T24. | Perform troubleshooting procedures on fuel cap test devices to restore correct function. | 2.44 |
| T52. | Perform OBD II test as prompted by the analyzer. | 2.44 |
| T58. | Evaluate vehicle inspection report (VIR) to identify areas that indicate vehicle failure. | 2.44 |
| T63. | Evaluate diagnostic readings to determine if a system failure may be causing other systems to fail. | 2.42 |
| T49. | Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle. | 2.39 |
| T56. | Perform functional test of fuel cap as prompted by the analyzer. | 2.39 |
| T62. | Perform diagnostic testing on vehicle systems as indicated by failure analysis. | 2.39 |

[4] Assumes a cutoff value of 2.5 on a four-point rating scale

| Item | | When Acquired[4] |
|---|---|---|
| T27. | Perform troubleshooting procedures on dynamometer to restore correct function. | 2.36 |
| T61. | Evaluate emissions results (e.g., excessive HC, excessive CO) to identify systems in vehicle that need diagnostic testing. | 2.36 |
| T19. | Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety. | 2.35 |
| T13. | Determine if vehicle is required to be tested at a specific type of station (e.g., referee, Gold Shield). | 2.34 |
| T28. | Prepare vehicle for emission inspection by warming engine to normal operating temperature prior to performing emission inspection. | 2.33 |
| T43. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of fuel evaporative (EVAP) system on vehicle. | 2.33 |
| T41. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of thermostatic air cleaner (TAC) system on vehicle. | 2.32 |
| T14. | Determine type of vehicle certification to evaluate vehicle emission label (e.g., California, Federal, BAR label). | 2.30 |
| T38. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of positive crankcase ventilation (PCV) system on vehicle. | 2.29 |
| T9. | Inform consumer of need for retest following repairs made to vehicle. | 2.27 |
| T40. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of exhaust gas recirculation (EGR) system on vehicle. | 2.27 |
| T42. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of air injection (AIS) system on vehicle. | 2.27 |
| T46. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks. | 2.27 |
| T55. | Perform functional test of the fillpipe restrictors when prompted by the analyzer. | 2.27 |
| T20. | Secure vehicle during emissions inspection (e.g., two-speed idle) by setting the emergency brake or chocks. | 2.26 |
| T39. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of catalytic converter system on vehicle. | 2.26 |
| T44. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control systems on vehicle. | 2.26 |

| Item | | When Acquired[4] |
|---|---|---|
| T47. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of sensors, switches, and computers on vehicle. | 2.26 |
| T48. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of other emission-related components on vehicle. | 2.25 |
| T45. | Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle. | 2.24 |
| T54. | Perform functional test of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures. | 2.24 |
| T11. | Determine accuracy of DMV renewal notice and vehicle information prior to performing smog check inspection (e.g., VIN label, license number). | 2.22 |
| T12. | Evaluate vehicle emission label to determine vehicle emission control requirements. | 2.21 |
| T51. | Perform functional test of vehicle's malfunction indicator light (MIL) as prompted by the analyzer. | 2.18 |
| T8. | Obtain consumer authorization to perform repairs on vehicle as determined by diagnostic testing. | 2.14 |
| T53. | Perform ignition timing check as prompted by the analyzer by following manufacturer procedures. | 2.14 |
| T7. | Obtain consumer authorization to conduct diagnostic testing of vehicle when vehicle fails smog check inspection. | 2.12 |
| T1. | Determine type of smog check inspection to be performed on vehicle (e.g., initial registration, renew registration, change of ownership, test-only). | 2.09 |
| T18. | Follow recommended safety procedures of vehicle and equipment manufacturers while servicing vehicle (e.g., inspection, diagnosis, repair). | 2.06 |
| T15. | Determine if minor repairs need to be performed on vehicle to ensure safety during smog check inspection (e.g., loose hose clamp, tire conditions). | 2.05 |
| T4. | Inform consumer of the option for an official pretest smog check inspection. | 2.00 |
| T17. | Maintain safety of testing area by keeping area clean. | 1.99 |
| T6. | Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs. | 1.98 |
| T2. | Determine if vehicle requires a smog check by evaluating vehicle information prior to performing smog check inspection. | 1.95 |

| Item | | When Acquired[4] |
|---|---|---|
| T16. | Perform minor repairs on vehicle if needed during safety inspection (e.g., tighten loose hose clamp). | 1.95 |
| T3. | Prepare work order to document smog check inspection to be performed and obtain consumer authorization. | 1.94 |

# APPENDIX G: TASK RATINGS – AFTER LICENSURE

In the needs assessment survey, the findings can assist in identifying tasks that technicians would acquire competency during industry training before licensure (Rating = 1) and tasks that technicians would acquire competency during required coursework before licensure (Rating = 2). Tasks with an average rating greater than 2.5 would indicate that tasks would be appropriate to include in update or other post licensure training (where Rating = 3 if task competency is acquired during industry experience after licensure; Rating = 4 if task competency is acquired during update training).

Therefore tasks to be included in post licensure training were:

| Item | | When Acquired[5] |
|---|---|---|
| T25. | Perform troubleshooting procedures on evaporative pressure test (LPEFT) equipment to restore correct function. | 2.62 |
| T57. | Perform evaporative pressure test as required. | 2.59 |
| T37. | Perform acceleration simulation mode (ASM) test as prompted by analyzer to measure vehicle emissions. | 2.58 |
| T33. | Perform two speed idle (TSI) test if prompted by analyzer. | 2.57 |
| T34. | Remove analyzer devices from vehicle following emission inspection as prompted by analyzer. | 2.57 |
| T30. | Enter technician access code into analyzer to validate technician authorization. | 2.55 |
| T59. | Perform baseline test on vehicle to verify failure identified on vehicle inspection report (VIR) prior to diagnosing failure. | 2.55 |
| T66. | Perform pre-inspection prior to retest to verify that repair is successful. | 2.55 |
| T22. | Inspect analyzer devices to ensure accurate functioning during smog check inspection or replace if needed. | 2.52 |
| T64. | Evaluate diagnostic testing results to determine if components of vehicle systems need to be cleaned, repaired, or replaced. | 2.52 |
| T31. | Prepare for emissions inspection by following analyzer prompts (e.g., insert probe, attach RPM pickup, enter vehicle information, restrain vehicle, cooling fan). | 2.51 |
| T32. | Perform pretest smog check inspection on vehicle if authorized by consumer. | 2.51 |
| T35. | Determine placement of vehicle on dynamometer prior to performing emission inspection (e.g., front wheel drive, rear wheel drive). | 2.51 |
| T50. | Perform visual inspection of vehicle to determine presence of excessive smoke (e.g., tailpipe, crankcase). | 2.51 |

[5] Assumes a cutoff value of 2.5 on a four-point scale.

# APPENDIX H: TRENDS IN ENROLLMENT AND PASS/FAIL RESULTS

Figure 6 – School success rate for Smog Check licensing examination 2/1/2001 – 12/12/2006

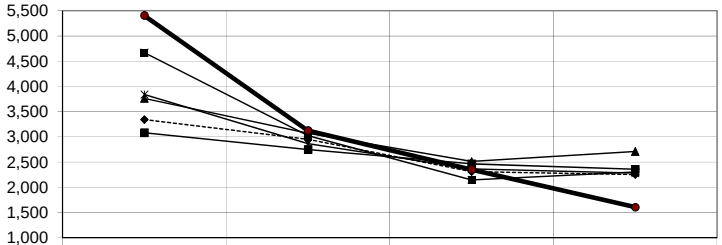
| Organization | | Exam Result | | | |
|---|---|---|---|---|---|
| | | Fail | | Pass | |
| | Total | # | % | # | % |
| California State and Community Colleges (public) | 2333 | 578 | 24.8% | 1755 | 75.2% |
| For-profit training institutions (private) | 4132 | 1754 | 42.4% | 2378 | 57.6% |
| Regional Occupational Programs, high schools, or adult education | 426 | 192 | 45.1% | 234 | 54.9% |
| BAR employees | 19 | 1 | 5.3% | 18 | 94.7% |
| Totals | 6910 | 2525 | 36.5% | 4385 | 63.5% |

Figure 7 – Licensing examination trends for CY 2004 – 2007

Table 4 – Course enrollment in BAR courses for CY 2004 - 2007

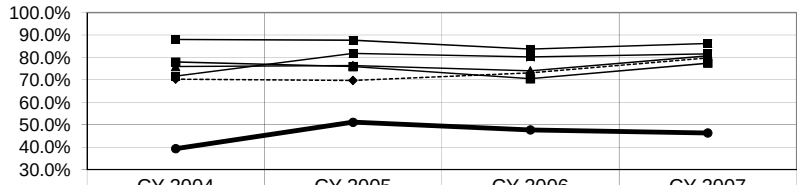
| Course Title | CY 2004 | CY 2005 | CY 2006 | CY 2007 |
|---|---|---|---|---|
| A6 - Engine Performance | 3,342 | 2,951 | 2,309 | 2,253 |
| A8 - Electrical/Electronic Systems | 3,080 | 2,748 | 2,465 | 2,360 |
| L1 - Advanced Engine Performance | 3,762 | 3,073 | 2,514 | 2,710 |
| CACC Basic | 4,667 | 3,021 | 2,146 | 2,306 |
| CACC Enhanced | 3,837 | 2,863 | 2,361 | 2,281 |
| Combined EA/EB License Exam | 5,403 | 3,124 | 2,353 | 1,608 |

Figure 8 – Course enrollment and licensing examination trends for CY 2004 – 2007




| | CY 2004 | CY 2005 | CY 2006 | CY 2007 |
|---|---|---|---|---|
| A6 - Engine Performance | 3,342 | 2,951 | 2,309 | 2,253 |
| A8 - Electrical/Electronic Systems | 3,080 | 2,748 | 2,465 | 2,360 |
| L1 - Advanced Engine Performance | 3,762 | 3,073 | 2,514 | 2,710 |
| CACC Basic | 4,667 | 3,021 | 2,146 | 2,306 |
| CACC Enhanced | 3,837 | 2,863 | 2,361 | 2,281 |
| Combined EA/EB License Exam | 5,403 | 3,124 | 2,353 | 1,608 |

Figure 9 – Course and licensing pass rate trends for CY 2004 – 2007




| | CY 2004 | CY 2005 | CY 2006 | CY 2007 |
|---|---|---|---|---|
| A6 - Engine Performance | 70.3% | 69.7% | 73.2% | 79.8% |
| A8 - Electrical/Electronic Systems | 78.0% | 76.0% | 70.5% | 77.5% |
| L1 - Advanced Engine Performance | 76.0% | 76.5% | 74.1% | 80.8% |
| CACC Basic | 71.7% | 81.9% | 80.3% | 81.7% |
| CACC Enhanced | 88.1% | 87.8% | 83.7% | 86.2% |
| Combined EA/EB License Exam | 39.3% | 51.1% | 47.7% | 46.3% |